TRANSIT COOPERATIVE RESEARCH PROGRAM

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TCRP Report 28

Transit Markets of the Future

The Challenge of Change

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This report will be of interest to transit policymakers, managers, planners, marketing professionals, and others interested in the effects of current trends (e.g., demographic, economic, social, land use, and transport policy) and trends expected over the next 15 years on current and future transit markets. Although many of these trends are not favorable to public transit, a number are identified that provide opportunities for maintaining current transit markets and creating new, expanded, or different transit markets. The report identifies 40 transit service concepts that appear to offer the most effective means of adjusting to these societal trends.

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Report 28

Transit Markets of the Future

The Challenge of Change

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with assistance from

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TRANSIT COOPERATIVE RESEARCH PROGRAM

The nation's growth and the need to meet mobility, environmental, and energy objectives place demands on public transit systems. Current systems, some of which are old and in need of upgrading, must expand service area, increase service frequency, and improve efficiency to serve these demands. Research is necessary to solve operating problems, to adapt appropriate new technologies from other industries, and to introduce innovations into the transit industry. The Transit Cooperative Research Program (TCRP) serves as one of the principal means by which the transit industry can develop innovative near-term solutions to meet demands placed on it.

The need for TCRP was originally identified in *TRB Special Report 213—Research for Public Transit: New Directions,* published in 1987 and based on a study sponsored by the Urban Mass Transportation Administration—now the Federal Transit Administration (FTA). A report by the American Public Transit Association (APTA), *Transportation 2000,* also recognized the need for local, problem-solving research. TCRP, modeled after the longstanding and successful National Cooperative Highway Research Program, undertakes research and other technical activities in response to the needs of transit service providers. The scope of TCRP includes a variety of transit research fields including planning, service configuration, equipment, facilities, operations, human resources, maintenance, policy, and administrative practices.

TCRP was established under FTA sponsorship in July 1992. Proposed by the U.S. Department of Transportation, TCRP was authorized as part of the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA). On May 13, 1992, a memorandum agreement outlining TCRP operating procedures was executed by the three cooperating organizations: FTA; the National Academy of Sciences, acting through the Transportation Research Board (TRB); and the Transit Development Corporation, Inc. (TDC), a nonprofit educational and research organization established by APTA. TDC is responsible for forming the independent governing board, designated as the TCRP Oversight and Project Selection (TOPS) Committee.

Research problem statements for TCRP are solicited periodically but may be submitted to TRB by anyone at any time It is the responsibility of the TOPS Committee to formulate the research program by identifying the highest priority projects. As part of the evaluation, the TOPS Committee defines funding levels and expected products.

Once selected, each project is assigned to an expert panel, appointed by the Transportation Research Board. The panels prepare project statements (requests for proposals), select contractors, and provide technical guidance and counsel throughout the life of the project. The process for developing research problem statements and selecting research agencies has been used by TRB in managing cooperative research programs since 1962. As in other TRB activities, TCRP project panels serve voluntarily without compensation.

Because research cannot have the desired impact if products fail to reach the intended audience, special emphasis is placed on disseminating TCRP results to the intended end users of the research: transit agencies, service providers, and suppliers. TRB provides a series of research reports, syntheses of transit practice, and other supporting material developed by TCRP research. APTA will arrange for workshops, training aids, field visits, and other activities to ensure that results are implemented by urban and rural transit industry practitioners.

The TCRP provides a forum where transit agencies can cooperatively address common operational problems. The TCRP results support and complement other ongoing transit research and training programs.

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The members of the technical advisory panel selected to monitor this project and to review this report were chosen for recognized scholarly competence and with due consideration for the balance of disciplines appropriate to the project. The opinions and conclusions expressed or implied are those of the research agency that performed the research, and while they have been accepted as appropriate by the technical panel, they are not necessarily those of the Transportation Research Board, the National Research Council, the Transit Development Corporation, or the Federal Transit Administration of the U.S. Department of Transportation.

Each report is reviewed and accepted for publication by the technical panel according to procedures established and monitored by the Transportation Research Board Executive Committee and the Governing Board of the National Research Council.

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Dr. Gordon J. "Pete" Fielding directed the Sec. 15 analyses of transit system data, conducted one case study, wrote the section on land use, prepared material on route restructuring, suggested some transit system implications, drafted some glossary terms, and provided insights on the interim and final drafts.

Mundle & Associates conducted four case studies, contributed materials on potential service concepts, and provided advice on the conduct of the study and on the interim and final drafts.

CONTENTS

FOREWORD

By Staff
Transportation Research Board

This report will be of interest to transit policymakers, managers, planners, marketing professionals, and others interested in the effects of current trends (e.g., demographic, economic, social, land use, and transport policy) and trends expected over the next 15 years on current and future transit markets. Although many of these trends are not favorable to public transit, a number are identified that provide opportunities for maintaining current transit markets and creating new, expanded, or different transit markets. The report identifies 40 transit service concepts that appear to offer the most effective means of adjusting to these societal trends.

During the past 30 to 40 years, the portion of urban trips carried by public transportation has declined. This decline has resulted largely from such factors as increasing suburbanization, increases in real income and vehicle ownership, changes in family life styles and household composition, and demands for increasing mobility. Will the decline in transit ridership continue or do these factors create a potential for new transit riders? How must transit adjust its services to meet the demands of an ever-changing marketplace? Answers to such questions will be crucial to the future of transit.

Demographic forces could produce dynamic new demands on transit. Conversely, there are some demographic changes that could result in relative stability in transit ridership. Other forces could alter the effectiveness of existing traditional fixed-route transit services. Some trends may be supportive; others may indicate the need to develop new concepts of service delivery and positioning strategies. For transit to be successful, the opportunities and threats generated by the marketplace must be understood.

Public transit must develop a vision of its role in serving existing and potential markets and ensure that transit benefits the entire population. Most transit operators believe that the greatest benefit is the mobility provided to those who ride transit today — workers traveling to congested urban centers; transit-dependent groups (e.g., senior citizens, students, individuals with disabilities, and the economically disadvantaged); and discretionary travelers who choose transit as the best mode of travel. Traditional transit services, however, will be challenged increasingly by demographic changes, geographic trends, economic influences, technological advancements, and societal concerns and expectations. The variability and direction of change in these factors require a careful assessment of their effects on existing and potential transit users and their influences on the future of transit services.

Under TCRP Project H-4B, research was undertaken by the Drachman Institute for Land and Regional Developmental Studies, The University of Arizona, to (1) identify the potential effects of anticipated demographic, geographic, economic, technological, and societal trends on today's transit ridership and services and (2) identify future transit markets resulting from these trends and the most appropriate services to address those markets.

To achieve the project objectives, the researchers first identified current transit markets using various sources, including the 1990 U.S. Census, 1991 American Housing Survey, and 1990 Nationwide Personal Transportation Study. The researchers then identified projected trends potentially influencing travel. Trends discussed include industrial restructuring; a flexible labor force; work at home and telecommuting; women's labor force participation; growth of the aging population, single-parent and single-adult households; suburbanization; migration and immigration; decreasing population and employment densities; increasing downtown employment density; increasing density in older suburbs; family support relationships; perception of crime; division of household responsibilities; transit funding; relaxation of transportation control mandates; and flexibility of the use of federal transportation funding. An assessment of how these societal trends will probably influence current transit markets was then performed. In addition, potential markets being created by these trends are identified, along with potential service options to meet these emerging needs. Finally, a brief analysis of the equity and efficiency implications of implementing these service options is presented.

TRANSIT MARKETS OF THE FUTURE—THE CHALLENGE OF CHANGE

PREFACE

Major societal changes have produced travelers with myriad variations in transportation patterns and needs, but transit systems have not been quick to understand the need to provide different travelers with targeted or specific services. Brad Edmondson, the editor of *American Demographics* commented in 1994,

> [T]ransportation planners must learn the basics of niche marketing. The consumers of transportation come in many shapes and sizes, and each segment has different needs. Like skilled marketers, planners must craft strategies rooted in consumer information that encourages people to chose mass transit . . . over private vehicles.[1]

Despite this real need, the Surface Transportation Policy Project recently noted,

> In transportation planning . . . we still seem to follow Henry Ford's dictum about Model T colors: "Give 'em any color they want, so long as it's black." . . . Planning transportation . . . solely around the work place or around median or average behavior obscures the real needs of real Americans.[2]

Public transit must assess the markets where its current strengths lie, consider what new markets exist or are evolving, evaluate how these new markets can best be served, and evaluate the areas where it is possible to strengthen the role of public transit. The striking and complex sociodemographic and industrial changes that are occurring worldwide create not just problems but new opportunities for transit operators to play a crucial role in urban mobility and accessibility.

TCRP Project H4-B, "Transit Markets of the Future—The Challenge of Change," was designed to objectively identify what potential or actual transit markets are created, strengthened, or threatened by these complicated societal changes. The study had four specific objectives as follows:

- To synthesize what has happened to transit use and ridership in various circumstances in response to the range of socioeconomic, demographic, and technical trends affecting U.S. society;
- To evaluate the direction and magnitude of future societal changes which might affect transit use, indicating new markets created by, as well as markets diminished by, these trends;

1. Brad Edmondson, "Alone in the Car," *American Demographics*, June 1994, p. 57.
2. "Putting People First," *Progress*, vol. IV, no. 7, Surface Transportation Policy Project, September 1994, p. 1.

- To analyze the kinds of transit services which could be fashioned to respond to emerging markets and niches while maintaining cost-effective services to existing markets; and
- To suggest to the transit community the political, financial, and institutional context needed for the successful development and implementation of appropriate services.

Tasks included the following:

- Identify current and emerging transit markets;
- Identify a range of projected societal trends—sociodemographic, economic, social, and policy—and then evaluate how these trends would affect the current transit markets identified in the first task;
- Identify societal trends which might maintain current markets or create new, expanded, or different transit markets;
- Identify transit options which might be appropriate for new and changing transit markets;
- Evaluate the effect of implementing the effective service options;
- Consider how sensitive projected effects were to policy and funding positions; and
- Recommend the best way to disseminate the study findings to the transit industry.

The results and analyses undertaken in these tasks are presented in this report in five chapters (described in the Summary). The eight appendixes contain a glossary, a list of areas included in each service environment, a description of the Section 15 analyses leading to the selection of the case sites, complete case studies of those sites, a comprehensive description of operational experiences with promising and effective service options, an evaluation of the attributes of promising options likely to lead to greater transit use in different service environments, and a full evaluation of the major societal trends affecting transit use.

SUMMARY

Many metropolitan areas face declining transit ridership. Many societal trends accelerate this problem. Although a few trends, such as increased immigration, have led to temporary increases in ridership in some communities, the complex industrial, demographic, and land use changes affecting U.S. society continue to erode ridership, even among the most dedicated groups of transit users. Soon, the losses will outweigh the gains. Some transit operators, however, have accepted the reality of these trends as a challenge to identify innovative opportunities, to better serve existing riders, and to find ways to provide different or improved transit services that attract new markets. These transit operators have maintained or even increased ridership through innovative planning and services.

This study focuses on communities that have expanded their markets or found new ones by providing different transit services that focus more on user needs and patterns. The study results are presented in five chapters, which are summarized in the following subsections.

CHAPTER 1: CURRENT TRANSIT MARKETS

Eleven groups of users, or markets, were identified as being more likely than average to use transit as their principal mode for commuting to work, relatively independent of their income or the size or density of the metropolitan areas in which they lived:

- Workers with low incomes,
- Workers with no household cars,
- Workers with college education,
- Blacks,
- Hispanics,
- Workers with graduate school,
- Workers age 17 to 29,
- Women,
- Asians,
- Immigrants (under 10 years in the United States), and
- Workers with mobility or work limitations.

The data show that there are distinctly different markets among those riding transit—it is unlikely that they all could or would be well served by the same services, routes, schedules, and marketing approaches.

CHAPTER 2: SOCIETAL TRENDS: THEIR EFFECTS ON CURRENT AND EMERGING MARKETS

To evaluate the effect of societal trends, research team personnel examined five aggregate categories of trends likely to affect the demand for transit in the future. These categories were as follows:

- Economic,
- Demographic,
- Social,
- Land use, and
- Transport policy.

Research team members found that most trends act to the detriment of public transit. Traditional transit services are best at serving large groups of travelers going to one or a few destinations along concentrated corridors of demand in concentrated peaks. Unfortunately, most of the societal trends analyzed reduce the net number of such travelers. For example, economic trends are creating a major class of workers who do not work in the same place each day or whose schedule changes frequently or who work late at night, early in the morning, or on weekends. Land use trends are resulting in longer trips which are more difficult to serve by transit.

In the short term, transit ridership may increase in absolute terms among some markets, simply because the population within that market is growing. For example, immigrants, who tend to rely heavily on transit, are increasing in number. However the absolute growth in these markets may not translate into greater total system ridership in either the short or long run because (1) the group's relative contribution to total transit ridership is so small or (2) the share of each group riding transit may be decreasing even as it increases in size (as a result of the same trends that negatively affect ridership among other groups).

CHAPTER 3: PROMISING SERVICE CONCEPTS: THEIR EFFECTS ON CURRENT AND EMERGING MARKETS

The research team found communities that had implemented new or different services or that had changed the ways in which they organized and targeted their tradi-

tional services and thus increased transit ridership by doing so. The research team found ridership data indicating that 13 service concepts were effective in increasing transit ridership—most in various metropolitan environments. These concepts are as follows:

- Feeder services,
- Express buses,
- Services to large employers,
- Reverse-commute services,
- Vanpool incentives,
- Park-and-ride services,
- Fare incentives,
- Travel training and transit familiarization,
- Light rail,
- Commuter rail,
- Route restructuring,
- Community buses/service routes, and
- Special event services.

Not every community that implemented one or more of these concepts was successful in maintaining or increasing ridership; however, the study findings suggest there are clear opportunities, despite immense barriers, to increase ridership by carefully targeting services to user needs and preferences.

The ridership increases occurred in the following 10 transit niches and markets (although not all services increased all the markets listed):

- People with disabilities,
- People age 17 to 25 (particularly university students),
- Children age 5 to 12,
- Blacks (particularly inner-city residents),
- Hispanics,
- Immigrants,
- People age 65 and over,
- People with high incomes,
- People age 50 and over, and
- Men.

Many of these riders are not those traditionally seen to depend on transit.

CHAPTER 4: SOCIETAL EFFECTS OF IMPLEMENTING PROMISING SERVICE CONCEPTS

The research team evaluated the societal benefits which might arise from implementing various effective service concepts. To do this, the research team (1) assessed the total potential ridership of each concept, (2) evaluated the equity and effectiveness of each effective service concept, and (3) used these assessments to give some idea of the relative magnitude of societal benefits offered by each effective service concept.

The research team concluded that the service concepts which provide the greatest societal benefits—that is, are the most equitable and efficient—are those that can affect the largest absolute number of riders. These concepts are as follows:

- Reverse-commute services,
- Services to large employers (including universities),

- Vanpool incentives,
- Route restructuring, and
- Feeder services.

Less efficient and equitable services are those which affect a much smaller subset of the population (even in cases where a higher percentage of those groups become transit riders). These services are as follows:

- Express buses,
- Light rail,
- Commuter rail, and
- Park-and-ride.

The assumptions on which these conclusions are based are controversial—the conclusions depend on currently observed ridership patterns—not on potential ridership. Rail systems, in particular, are said to be able to create major transit ridership by changing land use and so forth.

CHAPTER 5: IMPLICATIONS FOR TRANSIT AGENCIES AND THE INDUSTRY

To use the study findings successfully, transit systems must reconsider their traditional strategies, focusing first on rider needs and then on system constraints and resources. This often conflicts with how they have traditionally operated. Yet the study findings are as auspicious as they are pessimistic; operators can attract new riders, target new markets, and slow erosion of their ridership base.

Implementing many of the effective service options will pose multiple and serious challenges to many transit systems. But few of these challenges are as drastic or potentially devastating as the ones which await operators who do nothing to deal with the major changes in the travel patterns of most Americans. Unless they respond to their markets, most transit systems will see their ridership erode—and their public and political support with it.

Because this study raises many questions, the research team recommends appropriate agencies consider additional research aimed at the following:

- Refining the transit market groups identified in this study by using more sophisticated statistical methods to analyze current transit ridership patterns;
- Projecting the actual magnitude of changes in ridership in individual transit markets, assuming different societal trends;
- Identifying market patterns in a sample of individual metropolitan areas, using both aggregate and disaggregate data;
- Preparing comprehensive case studies of the implementation of effective (or promising) service concepts; and
- Conducting ongoing assessments of the outcome of implementing various market-driven service concepts.

CHAPTER 1

CURRENT TRANSIT MARKETS

INTRODUCTION

Current transit markets were identified using a four-part sequential process of

- Identifying those groups more likely to use transit than average in the aggregate of all metropolitan areas in the United States,
- Controlling for household income to identify those groups still more reliant on transit,
- Evaluating if groups more reliant nationally when controlling for income were still more reliant on transit when controlling for the population and density of metropolitan areas, and,
- Determining whether those groups remained more reliant on public transit when controlling simultaneously for income, metropolitan population, and metropolitan density.

The analyses were based on simple factor-by-factor cross-tabulations and indexes, although the 5 percent sample is so large that all relationships are statistically significant.

These analyses are described in the following four major sections. The first major section describes the data sources on which the analyses are based. The second major section focuses on current national home-to-work transit patterns, first in the aggregate and then by the type of transit and household income. The third major section explains how the research team divided all metropolitan areas into 14 service environments, categorized by population and density, and then examines home-to-work patterns in these environments. Current patterns are first examined in the aggregate within each category of service environment and then by income. The fourth major section presents a roughly comparable analysis of non-work travel patterns nationally in the aggregate and by income. Unfortunately, it was not possible to divide non-work trip patterns into service environments.

The last major section of the chapter summarizes current transit markets in the United States.

DATA SOURCES

The analyses were based on three major *user-reported* data sources: the 1990 U.S. Census 5 percent Public Use Microsample (PUMS) files, the 1991 American Housing Survey (AHS), and the 1990 Nationwide Personal Transportation Study (NPTS); a full discussion of these data sources and their strengths and weaknesses are given in Appendix A. Overall, the data presented five major problems.

First, the research team could not analyze work trip patterns within urbanized areas. The inability to incorporate density data at the urbanized area level forced the research team to focus on metropolitan-level data in the Census and the AHS. (The research team members were able to use urbanized area data in the NPTS.) Second, two of the three data sets—the Census and the AHS—ask for the "usual" or "principal" mode of travel; this approach undercounts people who occasionally use transit, make a multi-modal trip where the transit segment is shorter than the other segment(s), or take transit 1 or 2 days a week but not every day. Third, all of these databases underreport transit use because they undercount certain market groups such as poor people and illegal immigrants. Fourth, the Census and the AHS have data only on work trips. Finally, sample size problems arise when disaggregating the AHS and the NPTS transit data (for example, by sex, race, and income).

In the end, the research team relied largely on the Census data to identify work markets and on the NPTS to identify non-work transit markets. One advantage of the research team's reliance on the Census data is that, although the research team's analysis did not involve tests of the statistical significance of the differences in transit use rates, the metropolitan sub-sample of the 1990 PUMS Census data is so large—more than three million respondents—that almost all of the differences the research team describes would be statistically significant.

NATIONAL HOME-TO-WORK TRANSIT PATTERNS

Overall Patterns

To identify markets relatively more reliant on public transit, the research team indexed transit use patterns for various demographic groups to the average transit use rate for all metropolitan areas in the United States (6.86 percent), as shown in Table 1. This is actually a conservative estimate of

TABLE 1 Transit use by various market niches indexed to average metropolitan transit use

Market Niches	MSA Transit Index
Sex	
Men	.85
Women	1.18
Race and Ethnicity	
White	.68
Black	2.72
Hispanic (all races)	1.73
Asian	1.74
Vehicle Ownership	
No Car	5.76
One or More	.68
Age of Worker	
17-29	1.14
30-39	.96
40-49	.87
50-59	.92
60-64	1.07
65-69	1.10
Education	
No School	2.59
Elementary	2.08
Junior High	1.69
Some High School	1.25
High School	.91
Some College	.82
College	1.05
Graduate School	1.06

Market Niches	MSA Transit Index
Household Income	
< $5k	1.23
$5 - 10k	1.24
$10 - 15k	1.08
$15 - 20k	1.04
$20 - 25k	.97
$25 - 30k	.90
$30 - 40k	.78
$40 - 50k	.77
$50 - 60k	.84
$60 - 70k	.91
$70 plus	.95
Immigration Status	
Non-immigrant	.84
Immigrant	2.08
Years in US	
< 5	3.01
5 - 10	2.25
10 - 15	1.74
15 - 20	1.89
20 - 25	1.88
25 - 30	1.49
30 - 40	1.48
40+	1.80
Limitations	
Work Limitation	1.25
Mobility Limitation	2.41

Source: Unpublished tape readable data from the 1990 US Census, 5% PUMS

transit reliance because the average mode split for all metropolitan areas, 6.86 percent of workers, includes those groups more likely to use transit. However, this is a relative rating; transit use is fairly low in the United States so even groups shown to be disproportionately more reliant on transit may not use transit very much.

Those groups in Table 1 with an index above one were more likely than average to commute using transit in 1990; conversely those with an index below one were less likely than average to commute using transit.

The index is also an indicator of the magnitude of transit reliance; the higher the index, the greater the dependence on transit—workers in a group with an index of 2 were twice as likely as the average metropolitan worker to commute using transit. For example, those with no cars had an index of 5.76—which means that the percentage of workers with no cars who used transit was 5.76 times as high as the percentage of all metropolitan workers who commuted using transit.

The Census analysis shows that 14 groups were more likely than average to use transit as their principal mode for commuting to work in U.S. metropolitan areas in 1990. These 14 groups are as follows:

- Women,
- Blacks,
- Hispanics,
- Asians,
- Workers without household cars,
- Workers age 17 to 29,
- Workers age 60 and over,
- Workers with less than high school education,
- Workers with some high school but no degree,
- Workers with a college degree,
- Workers with graduate school education,
- Workers with household incomes below $20,000,
- Immigrants (regardless of the number of years that they have been in the United States), and
- Workers with a work or mobility limitation.

Some of these findings are expected; market groups long dependent on public transit were still disproportionately more likely to commute using transit in 1990. Almost 19 percent of Black workers, for example, used transit for their work trip in 1990 as did 13 percent of Hispanic workers and 12 percent of Asian workers. However, some of these findings are unexpected, including the greater relative dependence on transit among those with college education as well as among immigrants who have been in the United States for many years. That almost 17 percent of workers who reported a mobility limitation used transit may also be surprising.

Figure 1 illustrates one of the more unexpected patterns seen in Table 1, showing that transit use was substantially higher among both male and female immigrants than among non-immigrant travelers, regardless of how long the immigrants had been in the United States. Although transit use for the work trip was highest among recent immigrants, it never fell below 12.3 percent of female immigrants and 8.4 percent of male immigrants.

Moreover, immigrants who had been in the United States the longest—more than 30 years—were actually more likely to be transit users than those who had been in the United States for 10 to 30 years (although here the research team may be confounding immigration status with the age of worker because Table 1 also indicates that all older workers were more likely than average to use transit).

Patterns by Type of Transit

Perhaps some of the most surprising of the preceding analyses are those that show disproportionate transit use among more educated workers. When transit use is disaggregated by the specific transit mode—as described in the Census—and then by education, a more complicated picture emerges.

Figure 2 shows that the disproportionate reliance on transit among those with higher education actually reflects a growth in the use of subway and commuter rail. Among those with a college degree, almost 50 percent of all those using public transit were using the subway; roughly 25 percent were using commuter or heavy rail. In contrast, among those with a high school degree, subway use accounted for roughly 29 percent and rail for roughly 5 percent of all transit ridership.

Figure 3 shows similar transit patterns related to income: as workers' household incomes increase, they become more reliant on commuter rail; almost all of the increase in transit use seen among those with incomes above $40,000 was the result of increased commuter and heavy rail use. Roughly 40 percent of the total transit ridership of those with incomes above $70,000 was on commuter rail. In fact, more than 70 percent of the total ridership of that group was either on the subway or commuter rail. Conversely, bus and trolley use dropped fairly rapidly as income increased although the drop was far slower after incomes of $30,000 to $40,000.

On the other hand, increased transit use with the increasing age of the worker held constant, even when the research team examined for the use of various modes. The increase in transit use after 40 was the result of the growth in the use of all modes—with bus, trolley, and streetcar use increasing most sharply. In fact, as Figure 4 shows, almost 5 percent of workers 65 to 69 used just these combined modes (that is, without rail or subway) to go to work.

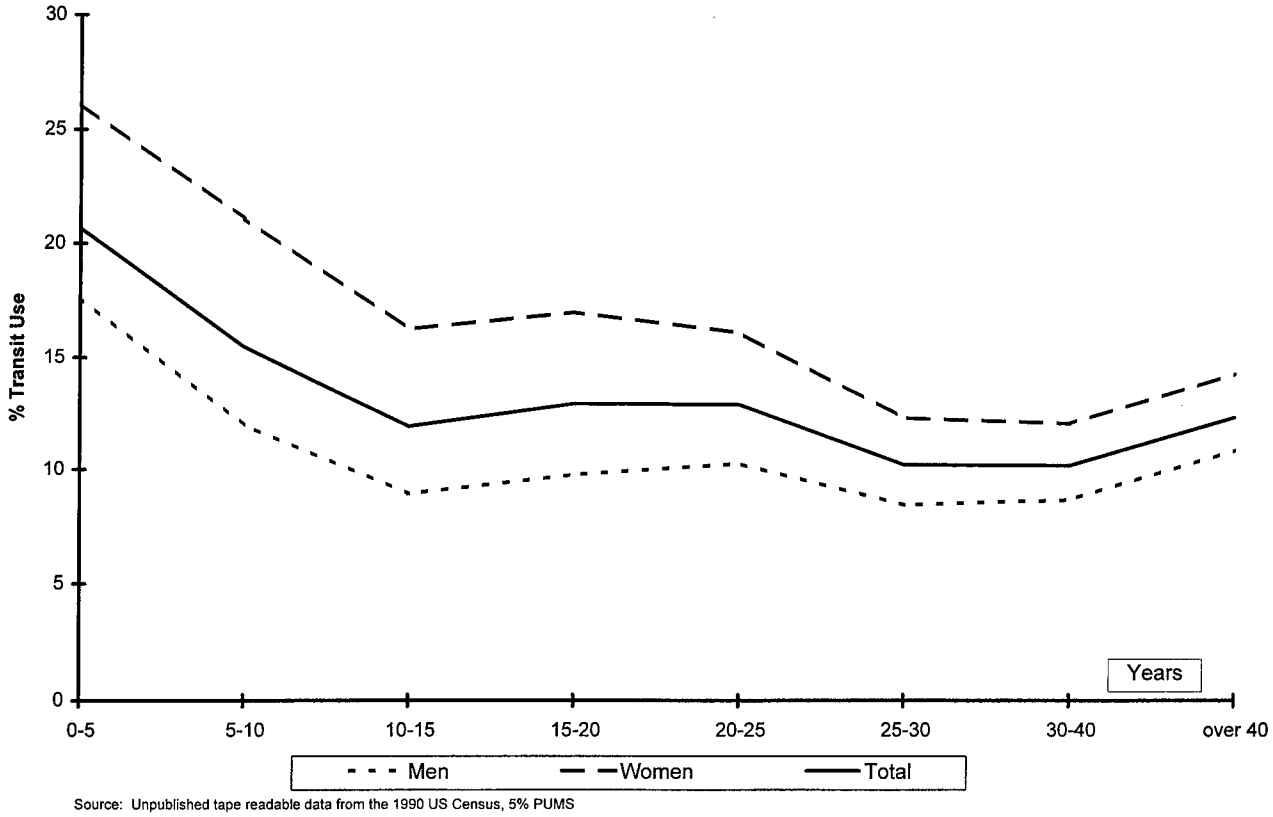


Figure 1. Transit use to work in metropolitan areas by immigrants, by sex and number of years in the United States.

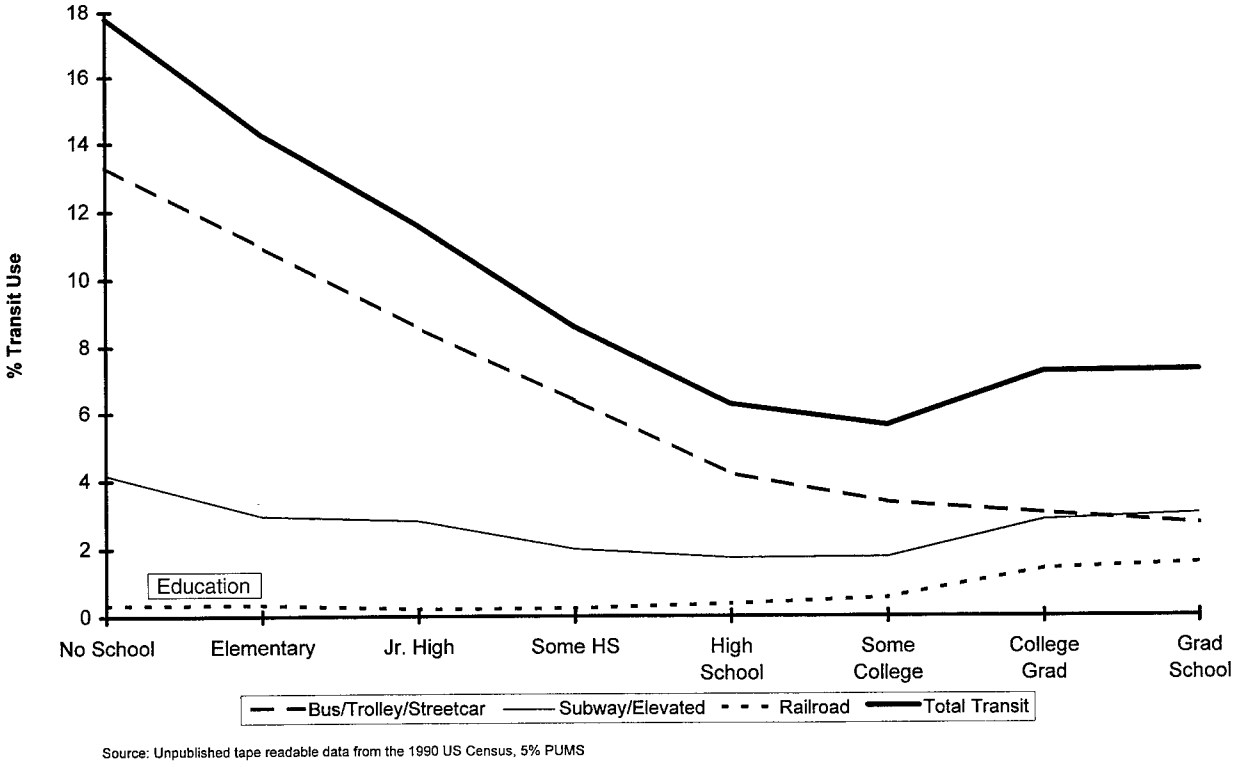


Figure 2. Transit use to work in metropolitan areas, by education and type of transit.

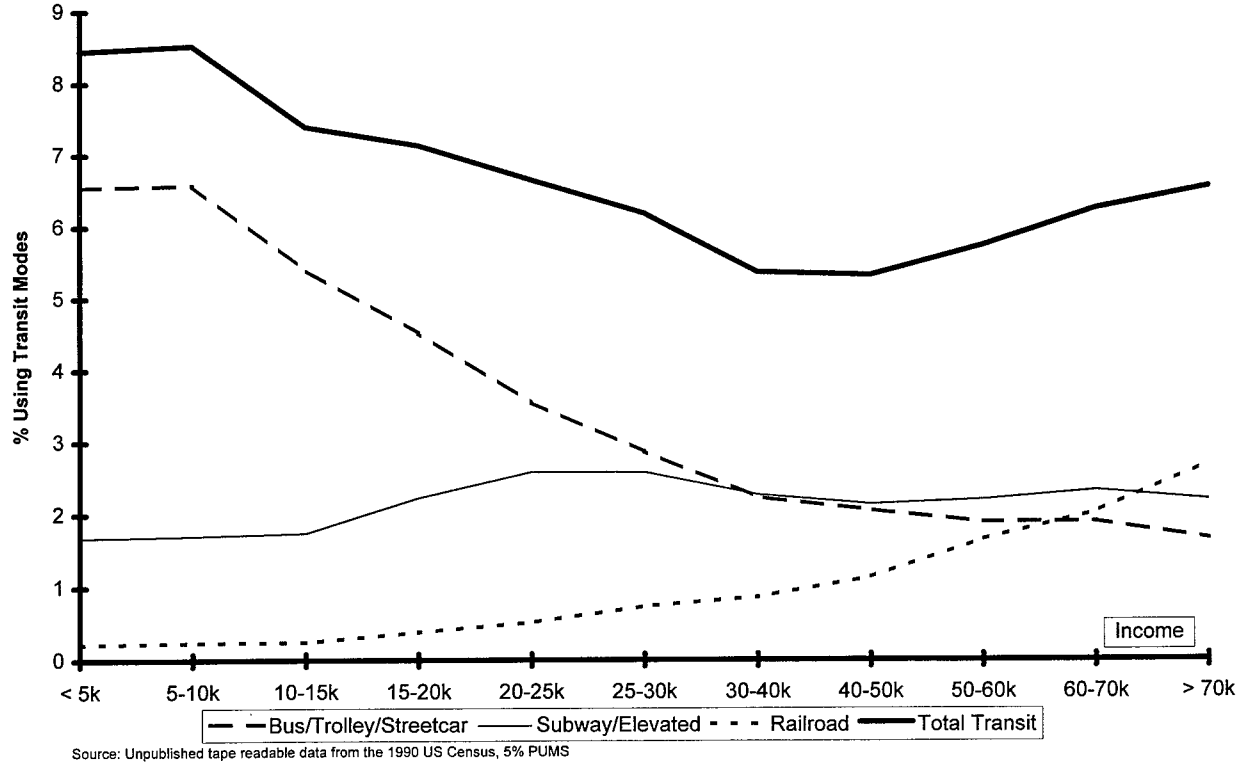


Figure 3. Transit use to work in metropolitan areas, by type of transit and household income.

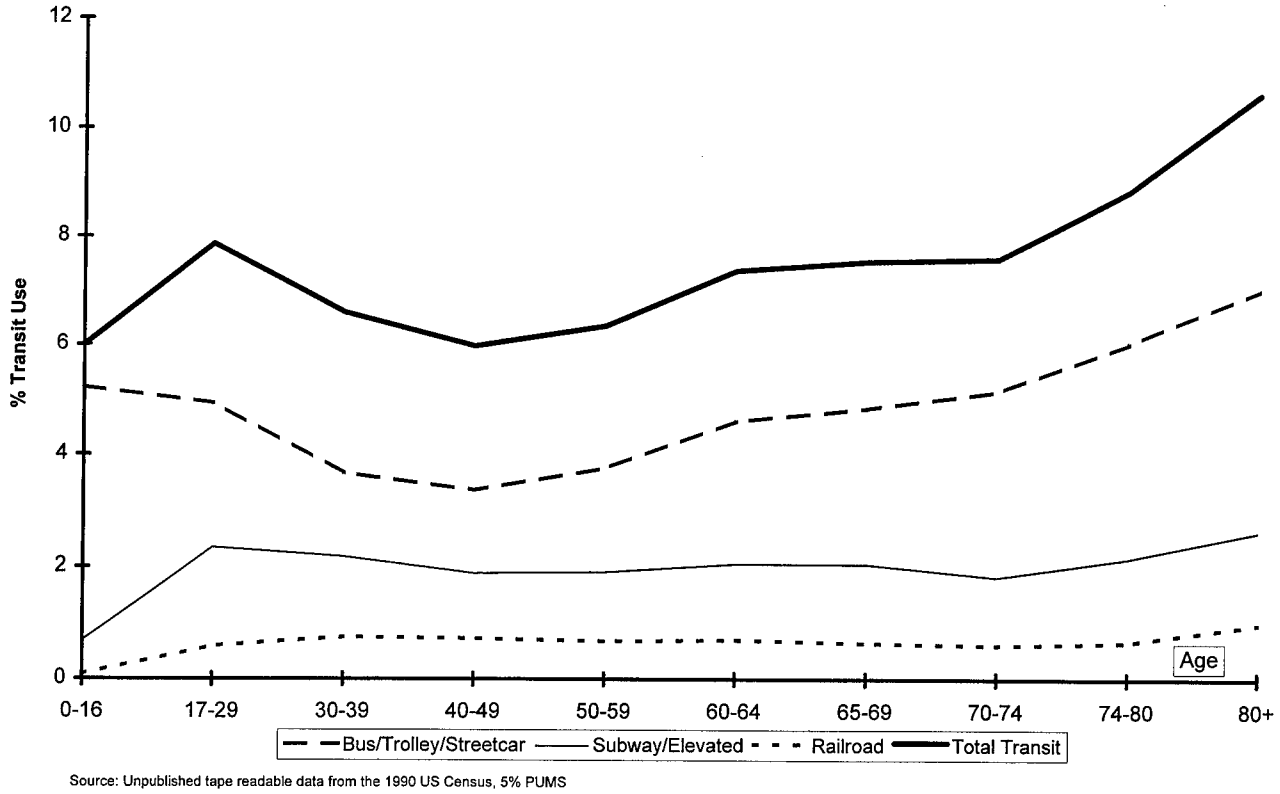


Figure 4. Transit use to work in metropolitan areas, by age and type of transit.

National Home-to-Work Patterns by Income

To the extent that transit use tends to drop with increasing income, some or all of the behavior of various groups seen in aggregate national analyses could reflect differences in household income. However, Table 2 shows that, of the 14 groups identified in the aggregate patterns as more likely to use transit than the metropolitan average, all 14 remain more reliant on transit even when controlling for household income.

The only group among whom the aggregate pattern does not hold is those with some high school education but no degree; only workers in this group with household incomes below $40,000 were more likely than average to use public transit.

Specifically, the analyses in Table 2 compared ridership for each market niche with the metropolitan average transit use for each of 11 specific household income categories as follows:

- Under $5,000: 8.45 percent,
- $5 – 10,000: 8.52 percent,
- $10 – 15,000: 7.39 percent,
- $15 – 20,000: 7.13 percent,
- $20 – 25,000: 6.65 percent,
- $25 – 30,000: 6.18 percent,
- $30 – 40,000: 5.36 percent,
- $40 – 50,000: 5.31 percent,
- $50 – 60,000: 5.73 percent,
- $60 – 70,000: 6.24 percent, and
- $70,000 plus: 6.54 percent.

The percent of transit use among each of these groups was indexed—within the 11 income categories—to the percentages listed above. For example, the percentages of Black, Hispanic, and female workers making less than $5,000 who used transit to commute to work were indexed to 8.45 percent. The research team members consider that a market niche had higher than average reliance on public transit controlling for income category if the index was higher than 1 in more than 8 to 9 categories. This is indicated in the second column in Table 2. Notable exceptions are also shown in Table 2. For example, although women were more likely to use transit than comparable male workers in 9 of the 11 income categories, they were not more likely to do so at incomes under $10,000.

Figure 5 illustrates one of the interesting patterns seen in Table 2. Workers with a mobility limitation were more likely to use transit than the average metropolitan worker at most income levels, sometimes by a factor of 2 or 3.

Table 2 makes it clear that workers in all 14 groups (including, by definition, the low-income group itself) were more likely to use transit than the average metropolitan worker controlling for income. These analyses directly

TABLE 2 Higher than average transit use to work in metropolitan areas

Potential Market Niches	Higher Than Metropolitan Average	Higher When Controlling for Income	Higher When Controlling for Mode and Income		
			Bus/Streetcar	*Subway*	*Rail*
Sex					
Men				● under $15k	
Women	●	●	●	● over $15k	● over $15k
Race & Ethnicity					
White					● over $40k
Black	●	●	●	● under $50k	● under $40k
Hispanic (all races)	●	●	●	●	
Asian	●	●	●	●	●
Vehicle Ownership					
No Car	●	●	●	●	●
One or more					
Age of Worker					
17-29	●	●	● over $30k	●	●
30-39		● over $50k		● under $10k over $40k	● over $30k
40-49					
50-59			● under $50k		
60-64	●	● under $50k	●	●	
65-69	●	●	●		
Limitations					
Work Limitations	●	● under $40k	●		
Mobility Limitations	●	●	●	●	
Education					
No School	●	●	●	●	
Elementary	●	●	●	●	
Junior High	●	● under $30k	●	●	
Some High School	●	● under $25k	●		
High School					
Some College					
College	●	●	● over $25k	●	●
Graduate School	●	●	● over $30k	●	●
Immigration Status					
Non-Immigrant					
Immigrant	●	●	●	●	●
Years in the U.S.					
< 5	●	●	●	●	●
5-10	●	●	●	●	●
10-15	●	●	●	●	● under $50k
15-20	●	●	●	●	●
20-25	●	●	●	●	●
25-30	●	●	●	●	●
30-40	●	●	●	●	●
40+	●	●	●	●	●

(continued on next page)

respond to the question of whether ethnic and racial minorities are really more likely to be transit users than the average traveler—given that so many ethnic and racial minorities are poor. The table shows that the income patterns of these groups are not obscuring different behavior among workers of color with higher incomes. Regardless of income, Black, Hispanics, and Asians are all more likely to use public transit than the average metropolitan worker.

Figure 6 illustrates these patterns. At all household income levels, Blacks, Hispanics, and Asians were more likely to commute using public transit than were Whites (and than the national average of all metropolitan workers). At the same

TABLE 2 (*continued*)

Potential Market Niches	Higher Than Metropolitan Average	Higher When Controlling for Income	Higher When Controlling for Mode and Income		
			Bus/Streetcar	*Subway*	*Rail*
Household Income		N/A			
< $5k	●		●		
$5-10k	●		●		
$10-15k	●		●		
$15-20k	●		●	●	
$20-25k				●	
$25-30k				●	●
$30-40k				●	●
$40-50k				●	●
$50-60k				●	●
$60-70k				●	●
$70k +				●	●

* higher than national average for mode for these income categories only
Source: Unpublished tape readable data from the 1990 US Census, 5% PUMS

time, of course, transit use did drop with increasing income among minority workers—it just never dropped as low as among other metropolitan workers with comparable incomes. Moreover, transit use patterns stabilized among workers of color at household incomes of roughly $40,000 but actually rose for White workers.

Hidden within the indexes in Table 2 are also some surprising patterns related to income. Although higher income groups were not more likely to use transit than the average metropolitan worker, they were at the same time, more likely to do so than middle income workers. For example, workers in households making $60,000 to $70,000 were more likely to commute using transit than were workers in households making $25,000 to $30,000.

Figure 7 illustrates these anomalies, showing that, although low-income people of both sexes were more likely to use transit than those with higher household income, (1) there were substantial differences between men and women and (2) transit use rose for both sexes at income levels above $40,000. As a result, women with incomes above $30,000, for example, were more likely to commute using transit than women making $10,000 to $15,000.

Figures 2 and 3 suggested that greater transit use among those with higher incomes and higher educational attainment might be the result of a greater dependence on commuter rail and rapid rail transit. The third column of Table 2 describes the results of an analysis of the interaction of income and the specific mode of transit used (again as described in the Census). These analyses show that, even though these groups make most of their transit trips on these modes, they are still generally more likely to use buses and so forth than the average metropolitan worker. For example, at incomes over $25,000, those with a college degree make more bus and streetcar trips to work than the metropolitan average; those with graduate training make disproportionately more bus trips than other workers at incomes above $30,000.

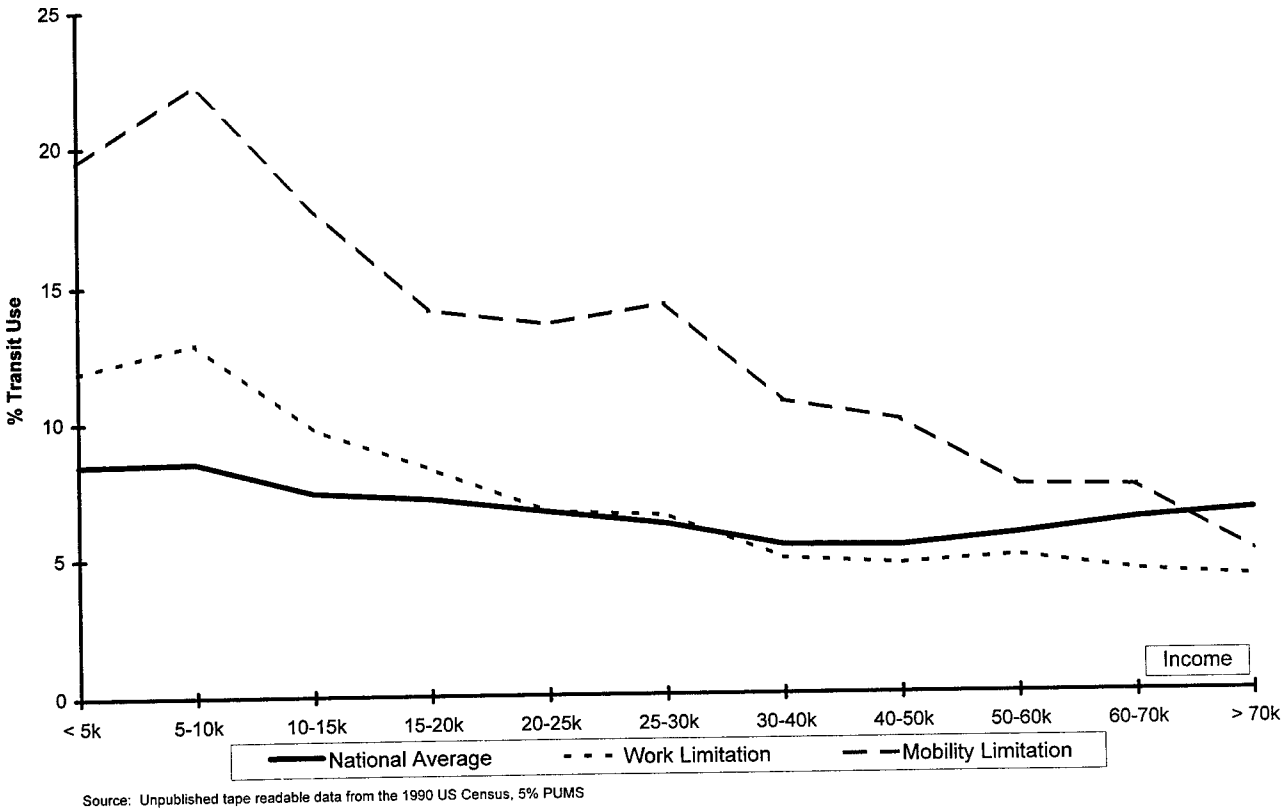
Summary

Relatively regardless of income, 14 overlapping groups of people compose the national market for public transit for the home-to-work trip. Although many of these groups have traditionally been more reliant on transit (e.g., minorities, women, and older travelers), it is surprising that their disproportionate reliance holds when income is also considered. Perhaps most surprising is the heavy reliance on transit by higher income immigrants.

HOME-TO-WORK PATTERNS IN INDIVIDUAL SERVICE ENVIRONMENTS

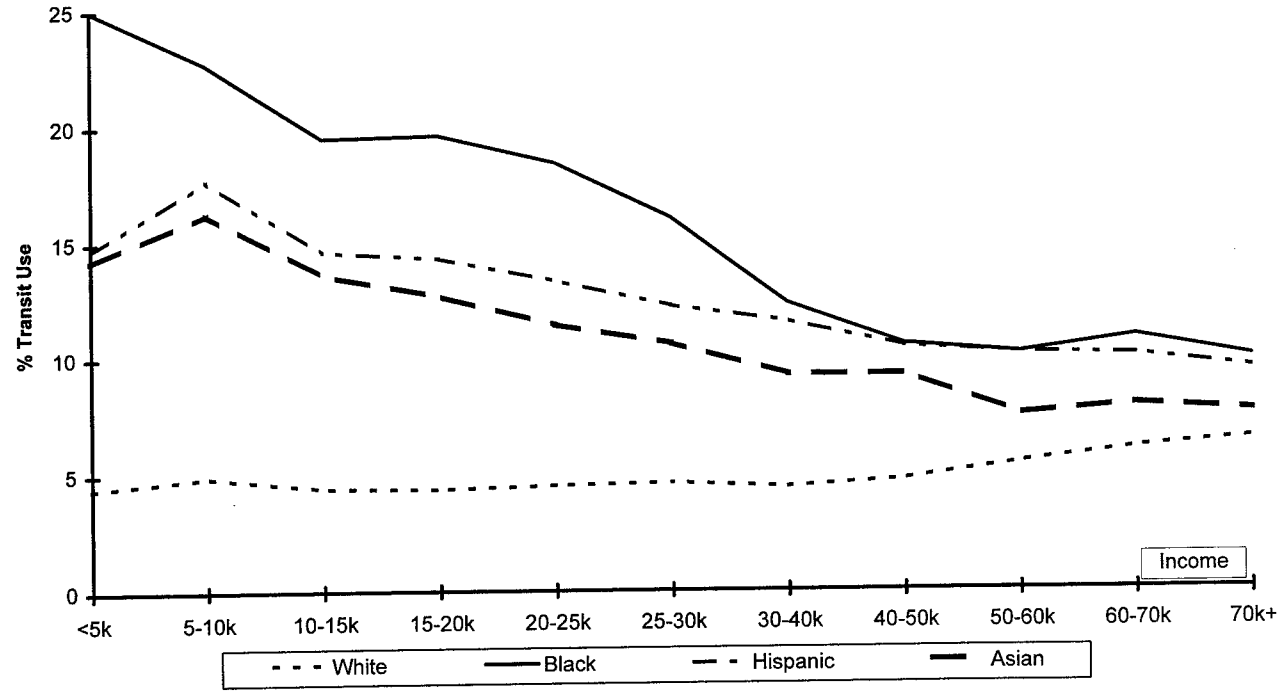
In the metropolitan areas of the United States, land use patterns, population density, racial and ethnic diversity, and the kind and amount of transit services available all differ remarkably. Therefore, the market groups just identified, such as Blacks or Hispanics or highly educated people, are only more likely to use transit than the average worker in aggregate national data because so many live in New York, Chicago, Philadelphia, or other major cities.

It would be expected that people living in areas with substantially more public transit services and higher density origin-destination (O-D) patterns would show higher than national average use of transit. Although such groups may not rely more on transit than other workers in their specific



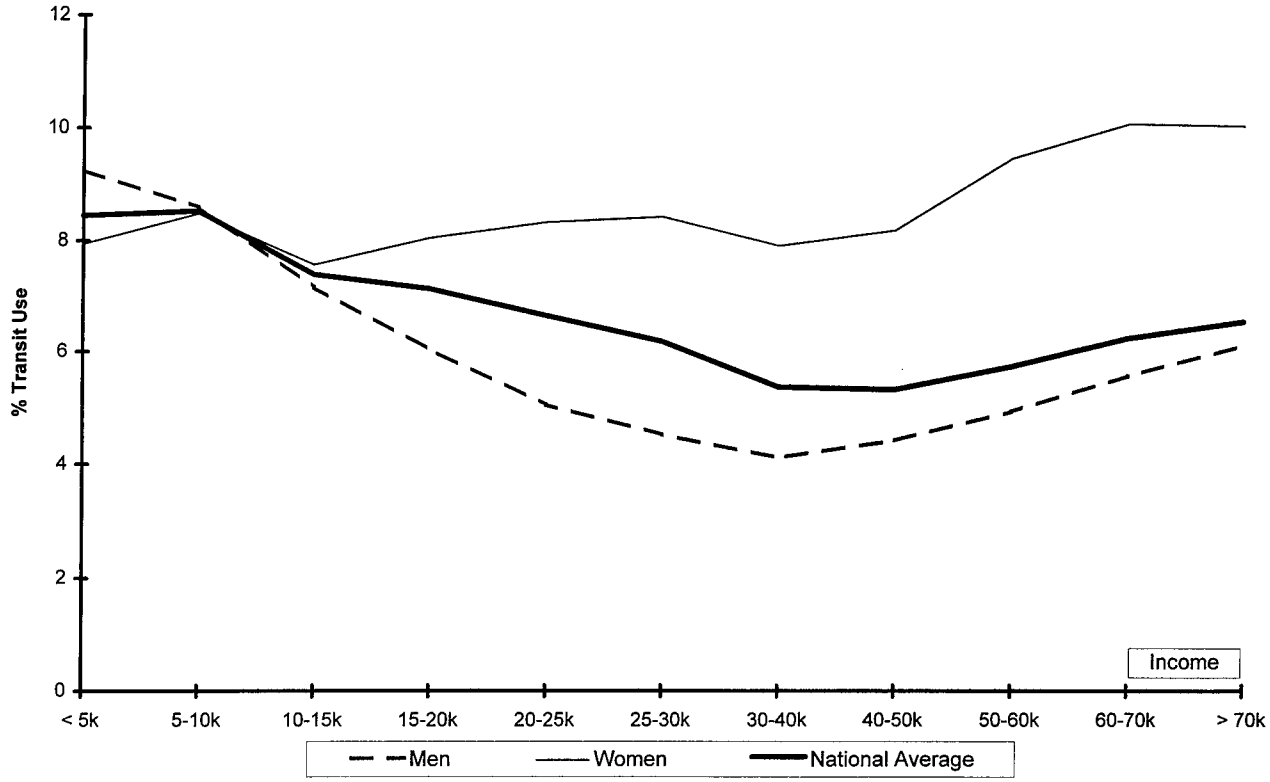
Source: Unpublished tape readable data from the 1990 US Census, 5% PUMS

Figure 5. Transit use to work in metropolitan areas by income, work limitation status, and mobility limitation status.



Source: Unpublished tape readable data from the 1990 US Census, 5% PUMS

Figure 6. Transit use to work in metropolitan areas, by race, ethnicity, and household income.



Source: Unpublished tape readable data from the 1990 US Census, 5% PUMS

Figure 7. Transit use to work in metropolitan areas, by sex of worker and household income.

metropolitan region, it may appear as if they do in unweighted national averages.

Therefore, it is important to investigate home-to-work travel patterns in different kinds of metropolitan areas. A metropolitan-level analysis should make clear which patterns seen in the national data represent simply the mathematical dominance of major cities, such as New York City and Chicago in national transit use data—and which patterns are seen in other metropolitan areas. However, it was beyond the scope of this study to look at every metropolitan area in the United States. To undertake the metropolitan analyses, the research team divided U.S. metropolitan areas into 14 specific service environments, categorized by both population and density.

Defining Service Environments

To develop individual service environments, the research team divided metropolitan areas into four population categories and then again into four density categories. The population categories were as follows:

- 50,000 to 200,000,
- 200,00 to 500,000,
- 500,000 to 1,000,000, and
- 1,000,000 and over.

The research team computed metropolitan area density data—available only at the county level—from the 1990 Census Summary Tape File STF3 and imported them into the 5 percent PUMS data. Because most communities in the United States have very low average density, the research team used only the following four categories:

- Very low: less than 50 people per sq. mile,
- Low: 50–1,000 people per sq. mile,
- Medium: 1,000–2,000 people per sq. mile, and
- High: more than 2,000 people per sq. mile.

Chicago and New York were evaluated as separate service environments—both because they are very different from most other U.S. metropolitan areas and because these two metropolitan areas together account for a substantial proportion of all transit ridership in the United States. Although there were 18 possible service environments (4 population categories multiplied by 4 density categories plus New York and Chicago), actual metropolitan areas existed only in 14 of the categories.

The research team members believe this approach is reasonable and useful, although it has problems. Using such large categories and categorizing as high density those cities with only 2,000 people per sq. mile may introduce some large biases. A bigger problem is using county-level density data because even very dense cities may be surrounded by low-density development, which artificially lowers metropolitan density as is the case in New York City. In addition, some service environments as defined here contain many apparently similar metropolitan service areas (MSAs) while other service environments have only a few, seemingly dissimilar, MSAs.

However, although the research team personnel recognize that these categories are far from perfect, the categories are a good first approach to understanding transit use in specific environmental contexts.

Identifying Transit Markets

In order to identify market groups disproportionately more likely to use transit within various metropolitan environments, the research team compared the specific service environment transit use of each of the 14 national market groups with average transit ridership in that service environment. The research team members first did so without controlling for income within service environments and then controlling for income categories. The aggregate analysis appears in this section, the income analysis in the next.

Table 3 summarizes the aggregate service environment analyses. A dot indicates that workers in the market niche in question were more likely to use public transit than the average worker in that service environment (that is, that the index was above 1). Table 3 shows that, of the 14 groups identified as more likely to use transit than the average metropolitan worker, most remained more likely to do so even when controlling for service environment. Twelve of the 14 groups were disproportionately more reliant on public transit for their work commute in 10 or more categories (or more than 70 percent of the metropolitan environments).

Of the 14 environments, four of the groups—women, immigrants, workers with no household car, and those with incomes below $10,000—were disproportionately more reliant on public transit for their commute than the average worker in their specific service environments.

Of the 14 groups, the following were more likely to use transit in 10 to 13 of the 14 service environments: workers ages 17 to 29, workers with less than high school education, workers with some high school education but no degree, workers with work and mobility limitations, Asians, Blacks and Hispanics. Older workers and those more highly educated were more likely to use transit than the average worker in 5 to 7 service environments.

At the same time, low income was associated with transit markets in most service environments. Those with incomes less than $15,000 were likely to create transit markets in almost every service environment—the exceptions tended to be in the smallest environments. At the same time, in the aggregate national figures, those with incomes as high as $20,000 were seen as more dependent on transit. This suggests that transit use among low-income workers in Chicago, New York, and so forth mathematically distorted the national indexes—even though those groups did not constitute higher than average ridership in those service environments.

In addition, these analyses show that immigrants who had been in the United States more than 10 years created only a few transit markets, even though these indexes were all greater than 1 in the national analyses. This suggests again that high transit use among long-term immigrants in some markets mathematically distorted the national indexes—even if long-term immigrants did not rely on transit more than others in those markets. However, unlike those with low income, immigrants in the United States for more than 10 years had high relative ridership in lower density service environments. This may reflect the movement of Asians and Hispanics—the largest groups of immigrants from abroad—to such communities in the South and West.

These analyses also reveal some markets not shown in the national analyses. There were three service environments where high-income workers were more reliant on transit than the average worker and not in Chicago and New York as might have been expected. In those service environments, travelers with high incomes were less likely to use transit than the average. Rather high-income travelers created a market in both medium- and high-density service environments between 500,000 and 1,000,000 and in medium-density environments between 200,000 and 500,000.

Because the magnitude of the reliance of various market groups is of interest, the detailed analyses on which Table 3 is based are shown in Tables 4 and 5. Table 4 covers metropolitan areas less than one-half million while Table 5 covers metropolitan areas larger than one-half million (including New York and Chicago). An index of more than 1 indicates that the group in question used transit for the work trip more than the average of all workers in that service environment. Numbers below 1 indicate that group used transit less than the average worker in that service environment.

These tables show that not only were Black workers, for example, more reliant on public transit than the average worker—they were many times more likely to use transit in most service environments and generally much more reliant in less dense communities. For example, Black workers in very-low-density metropolitan areas under 200,000 were almost 5 times as likely to use transit as the average worker. In fact, the percentage of Black workers using transit was more than 3 times as high as the average percentage in six

TABLE 3 Home-to-work transit markets by service environments

Market Niche ↓ / Population Density	50,000-200,000			200,000-500,000			500,000-1,000,000			over 1,000,000			Chicago	New York
	very low	low	medium	very low	low	medium	low	medium	high	low	medium	high		
Sex														
Men														
Women	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Race & Ethnicity														
White														
Black	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Hispanic (all races)	●	●	●	●	●	●	●	●		●	●	●	●	●
Asian		●	●	●	●	●	●	●	●	●	●		●	●
Vehicle Ownership														
No Car	●	●	●	●	●	●	●	●	●	●	●	●	●	●
One or More														
Age of Worker														
17-29	●	●	●	●	●	●	●		●	●	●	●	●	●
30-39	●								●					●
40-49														
50-59			●					●						
60-64		●	●	●			●	●		●				
65-69		●	●	●	●		●	●		●				
Limitations														
Work Limitations	●	●	●	●	●	●	●	●		●	●	●	●	
Mobility Limitations	●	●		●	●	●	●	●		●	●	●	●	●
Education														
No School	●	●	●	●	●	●	●	●		●	●	●	●	●
Elementary	●	●	●	●	●	●	●	●		●	●	●	●	●
Junior High	●	●	●	●	●	●	●	●		●	●	●	●	●
Some High School	●		●	●	●	●	●	●		●	●	●	●	●
High School	●			●			●			●				●
Some College		●							●	●				
College			●			●			●		●		●	●
Graduate School		●				●		●	●				●	
Immigrant Status														
Non-Immigrant														
Immigrant	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Years in the U.S.														
< 5	●	●	●	●	●	●	●	●	●	●	●	●	●	●
5-10					●	●	●	●	●	●	●	●	●	●
10-15	●		●					●						
15-20	●		●											
20-25				●										
25-30			●						●					
30-40														
40+					●				●					

(continued on next page)

TABLE 3 *(continued)*

Market Niche ↓ / Population Density	50,000-200,000			200,000-500,000			500,000-1,000,000			over 1,000,000			Chicago	New York
	very low	low	medium	very low	low	medium	low	medium	high	low	medium	high		
Income														
< $5k	●	●		●	●	●	●	●		●	●	●	●	●
$5-10k	●	●	●	●	●	●	●	●	●	●	●	●	●	●
$10-15k			●	●	●	●	●	●		●	●	●	●	●
$15-20k				●				●		●	●		●	●
$20-25k			●								●			●
$25-30k									●					●
$30-40k														
$40-50k									●					
$50-60k						●								
$60-70k						●								
$70k +						●		●	●					

● = higher than service environment average transit use = transit market
Source: Unpublished tape readable data from the 1990 US Census, 5% PUMS
The cities in each Service Environment are listed in Appendix B

more than 3 times as high as the average percentage in six service environments and 2 times as high in three more.

Other minority groups were also substantially more likely to use public transit than the average worker. Hispanic workers were 3 times as likely as the average worker to use transit in four service environments—generally the smallest and least dense. Moreover, Hispanic workers were more reliant on public transit than Black workers in four service environments.

Workers with either work or mobility limitations were also very reliant on public transit, particularly in metropolitan areas under one half million. For example, in low-density metropolitan areas under 200,000, workers with a mobility limitation were more than 10 times as likely to use public transit as the average worker in that service environment.

Tables 4 and 5 also show that poor educational attainment was much more linked with transit use than was low income. In most service environments, those with no more than a junior high education were 5 to 7 times more likely to use transit than the average worker. Those with incomes under $10,000, however, were "only" about 75 percent more likely to use transit. Several of the groups more reliant on transit were not a great deal more likely to do so. Female workers were only slightly more likely to use transit—their indexes ranked from 1.42 to 1.05. Young workers (i.e., those age 17 to 29) were only 25 percent more likely to use public transit than the average worker in most service environments.

The preceding analyses show that groups long thought to be more reliant on transit indeed used transit relatively more in most service environments—even smaller, lower density communities. These groups—women, those with no car, and ethnic and racial minorities—had indexes more than 1 in the national analyses because they were genuinely more likely to use public transit than comparably situated workers in many different kinds of metropolitan areas. Young and older workers and even the more highly educated were also genuinely more likely to use transit in several individual service environments.

The Effect of Income

However, the analyses above did not evaluate the effect of income within the 14 service environments. Even though the reliance of these groups on transit held when controlling for income in national patterns, higher transit ridership may be income-based within individual service environments but is distorted in aggregate numbers. Table 6 summarizes the analyses of the effect of income on transit ridership within the 14 individual service environments.

As in previous analyses, the transit patterns of each market niche were compared with average transit ridership within each service environment by income category. A market group was considered to show greater relative use of transit if that group's average ridership exceeded the income-specific service environment average in at least 8 of the 11 income categories.

Table 6 shows that income differences did not generally explain the dominance of most market niches, although the number of service environments where some groups had disproportionate transit use did drop. Eleven of the 14 national transit markets (the low-income categories are included by definition) were more reliant on public transit in most service environments (7 or more) even when controlling for income. Overall, aggregate transit rates within each service environment were not generally obscuring lower ridership among higher income people in these groups (even though few

TABLE 4 Transit use to work indexes by service environment in metropolitan areas under 500,000

Market Niches ↓ • population • density • average transit use	50-200,000			200-500,000		
	very low	low	medium	very low	low	medium
	.80%	1.60%	3.32%	3.60%	1.55%	4.40%
Sex						
Men	.95	.82	.62	.96	.79	.82
Women	1.06	1.22	1.42	1.05	1.25	1.20
Race and Ethnicity						
White	.93	.81	.81	.92	.75	.83
Black	4.99	3.03	3.45	2.11	3.23	2.40
Hispanic (all races)	.84	3.97	3.03	3.34	2.28	3.10
Asian	.96	3.15	2.52	1.04	1.83	1.55
Vehicle Ownership						
No Car	13.45	7.06	7.15	7.43	10.88	4.93
One or More	.69	.48	.75	.69	.68	.83
Age of Worker						
17-29	1.25	1.30	1.15	1.20	1.26	1.05
30-39	1.02	.81	.80	.76	.88	1.01
40-49	.69	.80	.87	.94	.83	.91
50-59	.82	.82	1.09	.99	.86	.69
60-64	.50	1.00	1.02	1.03	.97	1.11
65-69	.50	1.49	2.16	1.88	1.16	1.88
Education						
No School	7.46	4.59	1.37	7.83	12.80	1.18
Elementary	1.89	2.24	1.31	7.45	7.74	1.34
Junior High	2.46	1.71	1.51	2.44	.96	1.07
Some High School	1.39	1.53	1.36	2.01	.20	1.19
High School	1.07	.95	.92	1.02	.05	.65
Some College	.58	.88	.86	.73	.84	.73
College	.57	.84	1.18	.66	.76	1.44
Graduate School	.73	1.03	.51	.43	.90	1.58
Limitations						
Work Limitation	5.20	3.49	2.29	2.33	2.76	1.61
Mobility Limitation	14.68	10.48	.47	6.44	7.61	2.60
Household Income						
< $5k	1.90	1.83	.91	1.49	1.79	1.09
$5 - 10k	1.71	1.86	1.87	1.99	1.78	1.16
$10 - 15k	.91	1.01	1.54	1.40	1.22	1.05
$15 - 20k	.95	.74	.91	1.17	.80	.91
$20 - 25k	.30	.45	1.28	.51	.59	.75
$25 - 30k	.20	.49	.78	.32	.47	.63
$30 - 40k	.46	.52	.48	.39	.47	.70
$40 - 50k	.80	.64	.58	.28	.66	.94
$50 - 60k	.37	.50	.83	.33	.56	1.15
$60 - 70k	--	.80	.31	.60	.68	1.82
$70 plus	.20	.65	.91	--	.53	2.32
Immigration Status						
Non-immigrant	.88	.64	.95	.81	.95	.93
Immigrant	2.15	1.13	1.30	3.29	1.69	1.47
Years in US						
< 5	1.09	2.66	1.61	1.94	2.03	1.59
5 - 10	.81	.92	.98	.90	1.15	1.24
10 - 15	1.97	.56	1.05	.67	.75	.81
15 - 20	1.12	.69	1.53	.09	.82	.79
20 - 25	.69	.77	.11	1.33	.73	.93
25 - 30	.34	.56	1.36	.46	.52	.90
30 - 40	.50	.45	.48	.66	.55	.46
40+	--	.97	--	--	1.03	.72

(--) = too few entries

Source: Unpublished tape readable data from the 1990 US Census, 5% PUMS

Note: Transit use for each niche is divided by metropolitan average; unshaded numbers are indexes, not percentages.

market niches were more reliant on public transit at household incomes above $60,000 to $70,000).

Aggregate rates were just as likely to obscure higher income transit use among certain groups—college educated workers, workers with graduate school, and Hispanics—as the reverse. Two of the national market groups were reliant on transit in more service environments than in the aggregate analyses when income was taken into account. Those with a college education were more likely than average to use transit in all 14 service environments when controlling for household income.

The market niches with the most significant drop in the number of affected service environments tended to be those traditionally thought to be captive riders—those with work or mobility limitations, those with less than high school education, and those with some high school but no degree. The analyses suggest that these groups were more likely to use public transit only when they were poor, regardless of the service environment in which they lived.

The analyses also show that low income among several other groups was strongly linked to transit ridership. The last column of Table 6 indicates that in some service environments, older workers and immigrants in the United States for less than 10 years were more likely to be transit users only when they were poor. On the other hand, the table shows that low income rarely explained greater transit reliance among Blacks, Hispanics, or Asians. That is, among some of the 14 groups, income overlapped (or co-varied) with factors such as age or low educational attainment. But among other large groups, income did not significantly overlap other variables associated with transit use. In short, race, ethnicity, sex, higher educational attainment, and even immigrant status were often indicators of transit use where low income was not.

The most important question is not whether "only" poor people use transit. Whether or not any given group is more reliant on public transit "only" because they have low income, they are still important markets for public transit. This analysis only pursues these issues to indicate if there are unexpected or unexplored market segments among higher income workers. If so, these higher income groups are additional markets on whom transit operators could or should focus attention. Low-income workers remain a major transit market.

Overall, the four-part sequential analyses strongly indicated that some groups were genuinely more likely to use transit to commute to work than others of comparable incomes in many different kinds of metropolitan areas. Greater transit use among these groups was not generally explained by (1) differences among individual metropolitan areas which were otherwise mathematically obscured in national aggregate analyses or (2) differences explained by income within metropolitan areas. Although poor people and those living in large dense metropolitan areas were often more likely to use transit, neither income nor service environment explained higher than average transit use among Blacks, Asians, Hispanics, women, or those more highly educated, within most environments.

NON-WORK TRAVEL PATTERNS

To conduct a roughly comparable analysis of non-work trip patterns, the research team used urbanized area data from the 1990 NPTS. The NPTS is a very useful data set but it was not possible to use density data, so research team personnel were only able to conduct two of the three major analyses performed on the home-to-work data. (The NPTS is discussed in Appendix A.)

The NPTS records trips—not users. The data reflect not how people "usually" went shopping or "generally" got to the doctor but how they actually traveled on the day in question if they made such a trip. People who either made no non-work trips or those who traveled in a way out of the ordinary (for example, using a taxi because the car was broken) are recorded as if those patterns represented what they usually did. Moreover, the NPTS did not break out Asian travelers or immigrants.

Overall, transit use for all non-work trips in central cities is substantially below the work trip rate. Roughly 1.9 percent of all non-work trips are made using any transit mode—roughly one third the Census commute figure. Blacks and Hispanics are much more likely to use transit for their non-work trips than other travelers but not nearly as much as they are for work trips; 5.9 percent of the non-work trips of Blacks and 4.4 percent of the non-work trips of Hispanics are made using public transit.

Table 7 summarizes the non-work trip analyses; the first column shows that many groups who depend disproportionately on transit for the home-to-work trip also do so for non-work trips: those with incomes under $20,000, women, Blacks, Hispanics, those with no car, young travelers, and those with a high school degree or less. Strikingly, slightly higher income individuals are also more likely to use transit for non-work trips; those with household incomes as high as $30,000 are more reliant on transit. School-aged children are also more likely to use transit than other travelers in urbanized areas (these data excluded school bus travel, including only public transit modes, although respondents might have confused them).

However, in contrast to the commuter analyses, those with higher educational attainment are not more likely to use transit for non-work trips. In fact, such people are only more likely to use subways (and rail) than people with comparable incomes for non-work trips. Elderly people are not more likely to use transit for non-work trips, but older workers are more likely to do so to commute to work.

The second column of Table 7 also shows that almost all of the groups more likely to use transit for non-work trips in the aggregate continued to be more likely to do so when con-

TABLE 5 Transit use to work indexes by service environment in metropolitan areas over 500,000

Market Niches ↓ • population • density • average transit use	500-1,000,000			Over One Million			Chicago	New York
	low	medium	high	low	medium	high		
	2.35%	6.73%	28.81%	4.53%	10.40%	6.74%	16.75%	45.87%
Sex								
Men	.80	.76	.85	.79	.83	.95	.84	.91
Women	1.24	1.30	1.18	1.25	1.19	1.06	1.18	1.10
Race and Ethnicity								
White	.67	.69	.93	.63	.75	.80	.79	.84
Black	3.31	1.41	1.25	3.35	2.34	1.61	1.87	1.29
Hispanic (all races)	2.74	2.73	.53	1.91	2.33	1.71	1.59	1.20
Asian	1.38	1.55	1.27	1.18	1.42	.80	1.01	1.09
Vehicle Ownership								
No Car	10.17	5.14	1.78	8.14	4.46	2.24	3.45	1.48
One or More	.68	.86	.81	.71	.77	.32	.77	.74
Age of Worker								
17-29	1.21	.98	1.17	1.20	1.22	1.21	1.22	1.12
30-39	.86	.86	1.05	.95	.99	.95	.99	1.02
40-49	.84	.95	.89	.84	.85	.87	.84	.91
50-59	.95	1.16	.80	.87	.85	.84	.84	.92
60-64	1.22	1.46	.79	1.00	.92	.99	.91	.92
65-69	1.24	1.33	.76	1.06	.89	.86	.89	.94
Education								
No School	2.96	2.55	.80	2.40	1.89	3.10	1.40	1.22
Elementary	2.78	2.88	.86	2.09	1.41	2.56	1.05	1.12
Junior High	1.91	2.54	.77	1.71	1.34	2.22	1.11	1.13
Some High School	1.54	1.32	.84	1.43	1.22	1.32	1.02	1.09
High School	1.04	.90	.81	1.03	.94	.88	.86	1.00
Some College	.85	.81	1.01	.85	.89	.69	.96	.98
College	.69	.92	1.44	.84	1.07	.93	1.12	1.03
Graduate School	.68	1.13	1.20	.88	.98	.75	1.11	.83
Limitations								
Work Limitation	2.20	1.58	.89	1.56	1.19	1.23	1.25	.99
Mobility Limitation	4.53	1.81	.78	2.97	1.75	2.05	1.50	1.02
Household Income								
< $5k	1.79	1.43	1.18	1.54	1.22	1.62	1.19	1.04
$5 - 10k	1.76	1.39	1.05	1.56	1.27	1.79	1.16	1.07
$10 - 15k	1.25	1.29	.98	1.31	1.23	1.24	1.14	1.09
$15 - 20k	.91	1.25	.87	1.11	1.18	.82	1.14	1.14
$20 - 25k	.67	.79	.87	.88	1.08	.63	.97	1.09
$25 - 30k	.50	.70	1.02	.72	.95	.61	.93	1.06
$30 - 40k	.46	.58	.87	.57	.78	.63	.79	.93
$40 - 50k	.55	.47	.90	.54	.69	.68	.78	.82
$50 - 60k	.60	.61	1.15	.59	.72	.81	.87	.77
$60 - 70k	.66	.57	.98	.62	.77	.91	.93	.81
$70 plus	.67	1.16	1.26	.48	.71	.97	.95	.82
Immigration Status								
Non-immigrant	.96	.82	1.00	.96	.95	.30	.99	.93
Immigrant	1.62	1.90	1.01	1.38	1.29	.64	1.03	1.12
Years in US								
< 5	1.67	1.50	1.18	1.82	1.47	1.74	1.40	1.12
5 - 10	1.16	1.19	1.05	1.13	1.01	1.10	1.09	1.04
10 - 15	.91	1.09	.98	.82	.90	.76	.92	.98
15 - 20	.81	.93	.87	.82	.95	.69	.86	.97
20 - 25	.75	.62	.87	.71	.90	.61	.89	.99
25 - 30	.65	.57	1.02	.57	.78	.54	.80	.90
30 - 40	.78	.53	.87	.60	.63	.50	.79	.88
40+	.90	.47	1.07	.69	.74	.61	.97	.85

Source: Unpublished tape readable data from the 1990 US Census, 5% PUMS

Note: Transit use for each niche is divided by metropolitan average; unshaded numbers are indexes, not percentages.

TABLE 6 Summary of transit patterns in 14 service environments, by income

National Market Niche	Number of Service Environments Where National Market Niche:			
	Has Greater Relative Transit Use	Has Greater Relative Transit Use, Controlling for Income within Environment	Exceptions	Has Greater Relative Transit Use at Low Incomes Only
Women	14	12	-not under $10,000	none
Immigrants	14	8	-under $60-70,000	3
with <10 Years in US	11	8	-under $60-70,000	5
Workers with no Household Car	14	11		none
Workers with Household Income				
< $10,000	14	-	-	-
< $15,000	12	-	-	-
Workers 17-29	13	12	-not under $25-30,000	none
Workers with less than High School	13	5		7
Workers with				
- mobility limitations	13	5	-under $60-70,000	3
- work limitations	12	7	-under $50-60,000	4
Asians	12	9	-under $60-70,000	3
Workers with some High School	12	3	-under $60,000	9
Blacks	11	10	-under $60-70,000	1
Hispanics (all races)	13	13	-under $70,000	1
Workers 60+	7	5	-under $50,000	6
Workers with College	6	14	-not under $15-20,000	none
Workers with Graduate School	5	10	-not under $15-20,000	none

Source: Unpublished tape readable data from the 1990 US Census, 5% PUMS

trolling for the same 11 categories of household income used in the commuter analysis.* Only young children (age 5 to 12) were dropped as non-work market groups when income was considered.

Finally, Table 7 suggests that non-work travel is slightly less sensitive to the actual mode of transit used than are work trips. At the same time, those with higher educational attainment are more likely to use the subway than the average resident of urbanized areas (sample size problems precluded an analysis of all transit modes represented in the NPTS survey).

Figure 8 illustrates the effect of income on mode choice for non-work trips. As suggested by Table 7, there are important differences between and among the racial and ethnic groups. Transit use is never very high among White travelers, even among those with low household incomes, while relatively high for low-income Blacks and Hispanics. At the same time, the percentage of all trips taken using transit is relatively stable for Whites at household incomes over $30,000 while falling among Blacks and Hispanics.

The sharp hills and valleys in Figure 8 reflect sample size problems. However, it appears that Hispanics and Blacks are

* a) Under $5,000, b) $5 – 10,000, c) $10 – 15,000, d) $15 – 20,000, e) $20 – 25,000, f) $25 – 30,000, g) $30 – 40,000, h) $40 – $50,000, i) $50 – 60,000, j) $60 – 70,000, and, k) $70,000 plus.

substantially more likely to use public transit for non-work trips than comparable Whites at almost every income level but the highest. At the same, time low-income Hispanics are substantially more likely to use transit than comparable Whites or Blacks.

SUMMARY

The analyses in this chapter show that there are clear transit market groups among current riders, even when allowing for income and for size and density of metropolitan areas. Eleven niches constituted a transit market for work trips—that is, the workers had higher than average transit use in most service environments when controlled for income. These niches are as follows:

- Workers with low incomes (**NW**),
- Workers with no household cars (**NW**),
- Blacks (**NW**),
- Women (**NW**),
- Hispanics (**NW**),

TABLE 7 Non-work transit markets in urbanized areas

Potential Market Niches	Higher Than Urbanized Average (All Non-Work Trips)	Higher When Controlling for Income (All Non-Work Trips)	Higher When Controlling for Mode and Income	
			Bus/Streetcar	*Subway*
Sex				
Men				
Women	●	●	●	●
Race & Ethnicity				
White				
Black	●	●	●	●
Hispanic (all races)	●	●	●	●
Vehicle Ownership				
No Car	●	●	●	●
One or More				
Age				
5-12	●		●	
13-16	●	●	●	
17-29	●	●	●	●
30-39				
40-49				●
50-59				
60-64				
65-69				
Education				
No School	●	●	●	
Elementary	●	●	●	
Junior High	●	●	●	
Some High School	●	●	●	●
High School				
Some College				●
College				●
Graduate School				●
Household Income				
< $5k	●			
$5-10k	●			
$10-15k	●	N.A.	N.A.	
$15-20k	●			
$20-25k	●			
$25-30k	●			
$30-40k				
$40-50k				
$50-60k				
$60-70k				
$70k+				

Source: Unpublished tape readable data from the 1990 NPTS

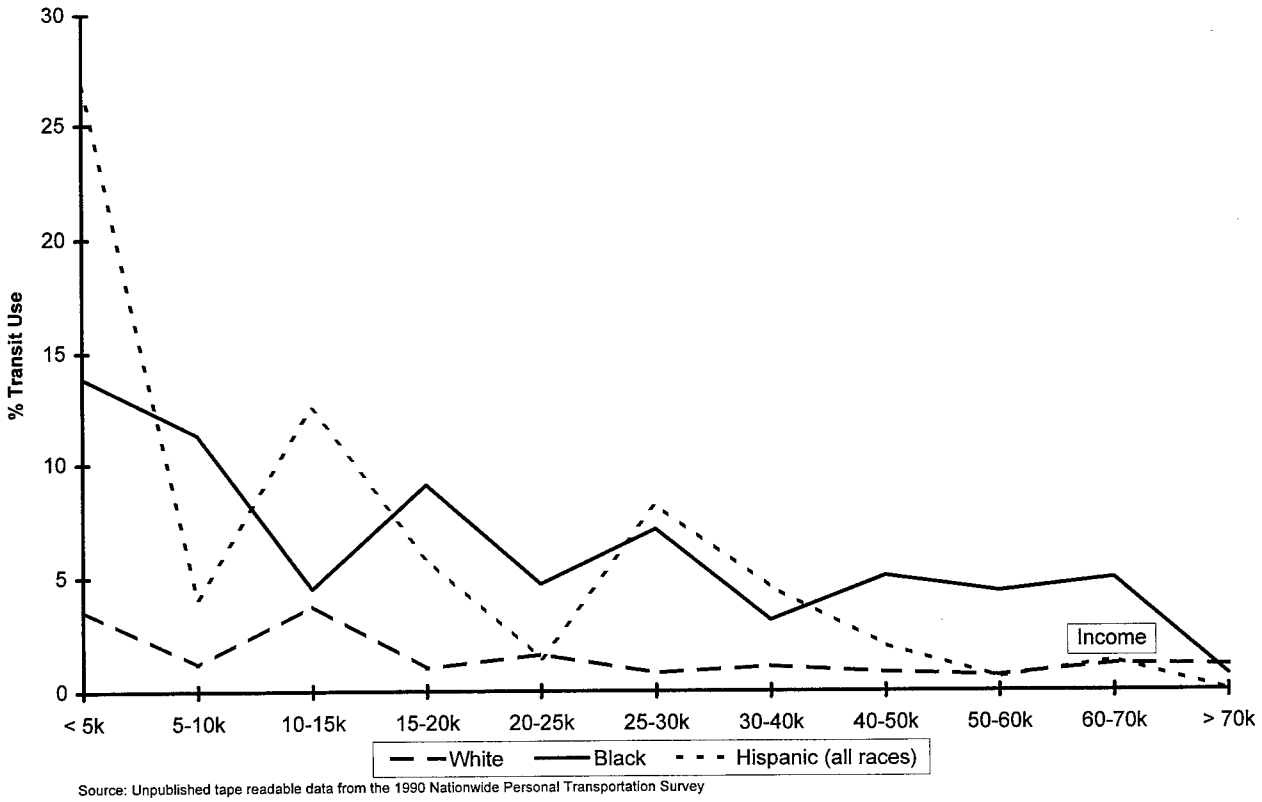


Figure 8. Transit use for non-work trips in urbanized areas, by household income, race, and ethnicity.

- Workers with graduate school education (**NW**),
- Workers age 17 to 29 (**NW**),
- Workers with college education (**NW**),
- Asians,
- Immigrants, and
- Workers with work limitations.

Those groups that were also a non-work transit market are identified by a **NW**; no data were available to evaluate the non-work market status of the other three groups listed above.

Three additional groups constituted a transit market for work trips in three to five service environments when controlling for income:

- Workers with mobility limitations,
- Workers age 60 and over, and
- Workers with some high school education (**NW**).

The approach used in this chapter shows quickly which groups rely more on public transit for work and non-work trips. Although the quantitative analyses performed have been limited, research team personnel have identified such clear patterns of transit use—some quite surprising—that they provide a sound basis for additional analyses. Local transit operators could easily perform similar evaluations using their own area-specific Census data and should undertake such analyses as part of their marketing and planning efforts.

At the same time, these kind of analyses provide the groundwork for more detailed quantitative studies, on the basis of either national or local data, which use statistical techniques which allow researchers to analyze the simultaneous interaction of variables (e.g., race and education) and the effect of co-variance (e.g., race and income). By suggesting some areas to explore, these analyses should serve as a guide for more ambitious statistical tests and evaluations beyond the scope of this project.

CHAPTER 2

SOCIETAL TRENDS: THEIR EFFECTS ON CURRENT AND EMERGING MARKETS

INTRODUCTION

This chapter summarizes an evaluation of how a range of projected societal trends—sociodemographic, economic, social, and policy—affect the current transit markets identified in Chapter 1. The full evaluation appears in Appendix C.

Although the research team focuses on national trends and effects, two points should be kept in mind. First, transit use is uneven; in all metropolitan areas combined, it accounts for less than 3 percent of all trips and 7 percent of work trips. However, ridership is substantially higher in certain areas. In communities as disparate as San Francisco, Pittsburgh, Atlanta, and Boston more than 20 percent of all workers take transit to work. Therefore, aggregate societal trends are unlikely to have the same effect on each metropolitan area. Second, although most trends have a negative effect on overall transit use, some give individual operators opportunities to increase ridership—at least in certain service areas or among certain riders—by targeting key markets with appropriate service options.

The first section below summarizes the effect of various societal trends on the current transit markets identified in Chapter 1. The second section evaluates the relative effect on transit ridership which might be expected from positive and negative societal trends. The third section summarizes this chapter's findings.

EFFECTS ON CURRENT MARKETS

The sections below summarize five aggregate categories of trends likely to affect the demand for transit in the future:

- Economic,
- Demographic,
- Social,
- Land use, and
- Transport policy.

The analyses in this chapter attempt to give a general indication of the effect of each set of trends on the current transit markets identified in Chapter 1. Each section following summarizes the likely effect of a key societal change on the absolute number of affected people using transit ("Total") and the percentage of each transit market ("Share") using transit. These indicators are only assessments of the implications of hundreds of intertwined changes, modifications, and shifts in dozens of overlapping societal arenas.

Although the summaries attempt to give some idea of the magnitude of the likely positive and negative effects, the standards the research team uses are actually qualitative assessments and relative ones at best. Positive effects are indicated by positive signs; strongly positive effects are indicated by multiple positive signs. Negative effects are indicated by minus signs; strongly negative effects by multiple minus signs. However, given the resources and focus of this study, there is no way to equate any of these signs to one another, except in the most general way.

Economic Factors

Four significant economic trends are likely to have important implications for transit markets and users:

- Industrial restructuring,
- Flexible labor force,
- Work at home and telecommuting, and
- Women's labor force participation.

The likely effect of these trends on current transit markets is shown in Table 8. The Total and Share indicators can be moving in opposite directions; the share or percentage of any market group using transit can fall while the total number increases (or vice versa). The net outcome can only be estimated at a gross scale; such an estimate appears in the next section of this chapter.

The major transportation and, ultimately, transit effects of the overall restructuring of national and international industry will arise from (1) different locational decisions made by service firms and industries; (2) growing income disparities; (3) the drop in the number of home-to-work trips; (4) wide variations in many individuals' work schedules and job locations; and (5) the complicated travel patterns of working parents, particularly women and single parents.

One major aspect of industrial restructuring is the growth of the service sector, which, in turn, has important transportation implications; the growing suburbanization and even exurbanization of jobs is linked closely to the growth of the service sector. Service industries tend to be smaller and, because they do not need to co-locate, tend to be widely dis-

TABLE 8 Effect of economic trends on transit markets

Transit Market (Service Environments)	Riders	Industrial Restructuring	Flexible Workforce	Work-at-Home	Women's Employment	Service Sector Growth
Low Income (14)	Total:	++	−	−	+	+
	Share:	−−	−−	−	−−	++
Workers with College (14)	Total:	+	−	−	−	−
	Share:	−	−	−	−	−
Hispanics (13)	Total:	+	−	−	+	−
	Share:	+	−	−	−−	−−
Workers 17-29 (12)	Total:	+	−	−	+	−
	Share:	−	−	−−	−	−−
Women (12)	Total:	+	−−−	−	+	−−−
	Share:	−−	−−	−	−	−−
Workers without Household Car (11)	Total:	++	−−	−	−	−
	Share:	−	−−	−	−	−−
Blacks (10)	Total:	+	−	−	−	−
	Share:	−	−	−	−	−
Workers with Graduate School (10)	Total:	+	−−	−	+	−
	Share:	−	−	−−	−	−
Asians (9)	Total:	+	−	−	−	−
	Share:	−	−	−	−	−
Immigrants (8)	Total:	+	−	−	−	−
	Share:	−	−	−	−−	−
Workers with Limitations (7)	Total:	+	−	−	−	−
	Share:	−−	−	−	−	−
Workers 60+ (5)	Total:	+	−	−	−	−
	Share:	−−	−	−	−	−
Workers with less than High School (5)	Total:	+	−	−	−	−
	Share:	−	−	−	−−	−
Workers with some High School (3)	Total:	+	−	−	−	−
	Share:	−	−	−	−−	−

persed within metropolitan and even exurban areas, rather than clustered and concentrated in the core of the city.

Dispersed employment locations can create nontraditional commute patterns. For example, the commutes of suburban and rural residents are twice as likely to be destined for suburban and rural work places as they are for the central city. All of these patterns are difficult to serve with transit; as they increase, transit use will fall.

Some economic effects might have a positive effect on transit use—the growing wage gap accompanying restructuring could increase the number of low-income workers. This might increase transit ridership because those with lower incomes have a greater tendency to use transit for both work and non-work trips.

On the other hand, the location of even low-paying service sector jobs may not be well served by transit; it is difficult to provide traditional service in low-density communities. The growing number of service workers with low or falling incomes may actually have to travel further to work simply because most available jobs are widely dispersed in suburban and even rural communities. Although more women are entering the labor force and the absolute number of women using transit may go up in the near future, over time, the percentage of working women using public transit may drop substantially, given the other pressures they face.

Chapter 1 showed that those with higher educational levels are more likely to use transit in most service environments—transit may be able to attract some higher income service workers, particularly those commuting to downtown. However, as Table 8 suggests, most of the economic trends will work against public transit operators. Although some trends may increase the absolute number of people in a current transit market, the same set of forces may decrease the percentage of those workers able or willing to use transit. For example, although the growing wage gap will probably increase the total number of low-income workers and create more transit riders among the poorly educated, most of the accompanying economic trends will substantially lower the percentage of those very workers able to use transit.

Demographic Factors

There are six major demographic factors underlying population change and diversity in the United States; these factors, which help to explain individual differences in travel patterns, are as follows:

- Growth of the aging population,
- Growth of single-parent households,
- Growth of single-adult households,
- Suburbanization,
- Migration (internal migration), and
- Immigration (external migration).

Table 9 summarizes the expected effect of these six trends on current transit markets, both absolutely and relatively.

Most demographic trends work against public transit. One of the few positive trends for transit is the growth of immigration. If current immigration policies continue, migration will have a substantial favorable effect, even in the absence of new services. The potential growth in young people and single-parent households might also lead to increased transit ridership, especially in the face of real income losses because of industrial restructuring.

However, it is not clear that transit will capture a larger share of these growing market niches. Most of the other societal trends are likely to adversely affect transit ridership—in the absence of new or different services—even among most groups proportionately more likely to use transit and even if the total population within each group increases.

The aging of the population may increase transit ridership but only for a short time, in the absence of new service arrangements, even though older people currently constitute a strong transit market. Most higher ridership by older people is probably a generational artifact—there is no evidence that people rely more on transit as they age. It is more likely that the higher transit use now seen among the elderly reflects the "transit habit" of a previous generation.

Moreover, almost all older people will be licensed in the near future and most will live in suburban or rural communi-

TABLE 9 Effect of demographic trends on transit markets

Transit Market (Service Environments)	Riders	Aging Pop.	Single Parent HH	Single Adult HH	Suburb-anization	Migration Internal	Migration External
Low Income (14)	Total:	+	+	+	−	−	+
	Share:	−	−	−	−−	−	
Workers with College (14)	Total:	−−	−	−	+	−	−
	Share:	−−	−−	−−	−	−	−
Hispanics (13)	Total:	−	−	−	+	−	++
	Share:	−	−−	−−	−	−	−
Workers 17-29 (12)	Total:	−	−	−	−	−	+
	Share:	−	−−	−−	−	−	−−
Women (12)	Total:	−−	−−	−−	−	−	−
	Share:	−−−	−−−	−−−	−−−	−−−	−
Workers without Household Car (11)	Total:	−	−	−	−	−−	−
	Share:	−	−	−	−−	−−	−−
Blacks (10)	Total:	−	−	−	−	−	−
	Share:	−	−	−	−−	−−	−−
Workers with Graduate School (10)	Total:	−−	−	−	+	−	−
	Share:	−−	−−	−−	−	−	−
Asians (9)	Total:	−	−	−	+	−	++
	Share:	−−	−	−	−	−−	
Immigrants (8)	Total:	+	−	−	+	−	+
	Share:	−	−	−−	−−	−	
Workers with Limitations (7)	Total:	+	−	−	−	−	−
	Share:	−	−	−	−	−	−
Workers 60+ (5)	Total:	+	−	−	−	−	−
	Share:	−−	−−	−−	−−	−	−
Workers with less than High School (5)	Total:	+	−	−	−	−	+
	Share:	−−	−	−	+	−	−
Workers with some High School (3)	Total:	+	−	−	−	−	+
	Share:	−−	−	−	+	−	−

ties with few alternatives to driving alone. Although older people who are poor may continue to depend disproportionately on transit, the percentage of older travelers who are poor has declined substantially.

The growth in the number of households is linked to the growth in per capita car ownership; that growth rate alone poses serious problems for transit operators. Once any traveler has bought a car, the marginal cost of additional trips may be small; the cost of driving may even be perceived as less than the cost of a transit fare.

The growth in the number of single-parent households may increase total transit ridership because so many are poor; however, other societal trends act in ways likely to lead to lower market share among single parents. The continuing suburbanization of the low-skill jobs available to many single female parents, the need to reverse commute, and the demands created by balancing work and home without a resident partner may well sharply decrease the share of this market using transit, even as the total numbers of people in the market increase.

Suburbanization coupled with migration to the lower density West and South of both residents and immigrants will work against transit use. Suburban sites are not well served by traditional transit options, even if immigrants and others choose to live in higher density suburbs. Transit may increase total ridership from the growing number of low-income reverse commuters, but—in the absence of new service arrangements—it is also likely that transit will lose market share among those reverse commuting, because these trips are often the most difficult to take using traditional transit alternatives.

As Table 9 suggests, the most potentially positive demographic trends for transit are the aging of the population and continued immigration. Even these trends contain the seeds of their own destruction. The rest of the demographic trends will work against transit.

Land Use Factors

Land use patterns and density significantly affect transit markets; the following four major changes in land use affect current transit markets:

- Decreasing population density,
- Decreasing employment density,
- Increasing downtown employment density, and
- Increasing density in older suburbs.

Table 10 suggests that most land use trends work against public transit; however, a few hopeful situations exist. Growing suburbanization generally provides limited opportunities for transit use, but increasing population concentrations in some older suburbs and concentrated suburban employment sites provide greater suburban destinations for transit operators than in the past. In addition, the central city remains the destination of a larger and absolutely growing number of jobs—thus providing another growing market for transit service.

A signal feature of industrial restructuring is that the jobs in the traditional core of the city have changed from production to high-end service jobs—in banking, insurance, communication, and public administration. These jobs are filled by more highly educated workers, who already are more likely to use public transit than the average worker. This current market may well grow as the number of downtown jobs grows.

At the same time, new immigrants are largely settling in the suburbs, despite historical patterns to the contrary. In many places, they are settling in inner suburbs, which have denser land use development to begin with; when these suburbs become enclaves of immigrants, population density often climbs. The combination of these forces provides a more attractive climate for the provision of transit services.

Overall, however, Table 10 shows that most of the urban land use changes will have negative consequences for transit operators. At the same time, some transit operators may be able to take advantage of new pockets of potential riders in older suburbs and among downtown commuters.

Transport Policy Factors

Four major policy trends are likely to affect transit ridership in the coming decade:

- Decreasing federal transit assistance,
- Relaxation of transportation control mandates,
- Service to people with disabilities, and
- Diversion of highway funding ("flexing").

The effect of each of these trends is shown in Table 11. Reductions in federal transit financial assistance are making it more difficult for transit systems to maintain existing markets, let alone to develop new markets. On the other hand, transit agencies are required to provide a significant level of service to people with disabilities, which has increased transit ridership among people with disabilities, either directly or indirectly. The costs of such services are high, however, and often come at the expense of transit services targeted at other market groups.

A hopeful sign is that ISTEA permits the "flexing" or diversion of highway funds to projects supporting transit; several cities are planning to use these funds to build joint developments, park-and-ride facilities, and childcare centers at transit stations.

At the same time, however, the ridership effect of the kind of efforts associated with flexible Federal funds is either not high or not known. For example, while many analysts hold high hopes for childcare centers, even if they are wildly successful in converting car users into transit riders, each childcare center can only affect the travel patterns of a few dozen

TABLE 10 Effect of land use trends on transit markets

Transit Market (Service Environments)	Riders	Declining Density		Increasing Density	
		Population	Employment	Downtown Employment	Older Suburbs
Low Income (14)	Total:		−−		
	Share:	−−			+
Workers with College (14)	Total:	−	−−	+	
	Share:	−−	−−−	+	
Hispanics (13)	Total:	−	−−	+	++
	Share:	−−−	−−−	+	+
Workers 17-29 (12)	Total:		−−		
	Share:	−−	−−−		
Women (12)	Total:	−−	−−		
	Share:	−−−	−−−		
Workers without Household Car (11)	Total:	−	−−	+	
	Share:	−−−	−−	+	
Blacks (10)	Total:	−			
	Share:	−−−	−−−		
Workers with Graduate School (10)	Total:	−	−	+	
	Share:	−	−	+	
Asians (9)	Total:	−		+	++
	Share:	−−−	−−	+	+
Immigrants (8)	Total:	−	−	+	++
	Share:	−−	−−	+	+
Workers with Limitations (7)	Total:	−	−		
	Share:	−	−		
Workers 60+ (5)	Total:	−	−		
	Share:	−−	−−		
Workers with less than High School (5)	Total:	−	−−−	+	
	Share:	−	−−−	+	
Workers with some High School (3)	Total:	−	−−−	+	
	Share:	−	−−−	+	

commuters. Joint developments can take years to come to fruition, so, even if very successful, their effect will be a long time in the future.

Most existing policy trends have little to no effect on most current transit markets or they have considerable negative effects.

Social Factors

Americans have changed the way they relate to one another within the family and outside it. The aging of society, the growing number of two-worker households, the large number of mothers (of young children) who have salaried employment—all interact to affect current transit markets. Three sets of interpersonal relationships affect transit use:

- Family support relationships,
- Division of household responsibilities, and
- Perception of crime.

Table 12 summarizes the effect of these sets of relationships on current transit markets. None of the interrelated trends is likely to increase either current markets or the percentage of those riders who use transit.

Family members caring for older parents, people being afraid of traveling, working parents whose multiple responsibilities constrain their mode choice—all have a net negative effect on fixed-route transit ridership. Overall, fewer elderly people will be inclined to use public transit; as their mobility declines, their children and younger relatives will transport them. As a result, transit ridership may not only drop among the elderly but among their caregivers as well.

Two-worker families, especially with young children, have a different set of constraints that act to reduce transit use. The need to link trips to work with trips to carry out childcare or other domestic responsibilities substantially reduces the attractiveness of public transit to many current transit markets (e.g., women, low-income workers, and ethnic and racial minorities). If these families are also caring for older relatives, the demands on their time effectively preclude the use of transit.

In addition, people's fear of crime is growing. Women, the elderly, and those with work or mobility limitations may feel more vulnerable to street crime and may attempt to reduce

TABLE 11 Effect of transportation policy trends on transit markets

Transit Market (Service Environments)	Number of Riders	Decreasing		Increasing	
		Federal Funding	Transportation Control Measures	Service to People with Disabilities	Diversion of Highway Funding
Low Income (14)	Total:	−−		+	
	Share:	−−−		+	
Workers with College (14)	Total:	−	−		
	Share:	−	−−		+
Hispanics (13)	Total:	−−	−		
	Share:	−−−	−		
Workers 17-29 (12)	Total:	−			
	Share:	−−			
Women (12)	Total:	−			
	Share:	−			+
Workers without Household Car (11)	Total:	−	−−		
	Share:	−−	−−		
Blacks (10)	Total:	−−			
	Share:	−−−			
Workers with Graduate School (10)	Total:	−	−		
	Share:	−	−−		+
Asians (9)	Total:	−	−		
	Share:	−	−		
Immigrants (8)	Total:	−			
	Share:	−			
Workers with Limitations (7)	Total:	−		+	
	Share:	−−		++	
Workers 60+ (5)	Total:	−		+	
	Share:	−		+	
Workers with less than High School (5)	Total:	−−			
	Share:	−−−			
Workers with some High School (3)	Total:	−−			
	Share:	−−−			

their street exposure. In most metropolitan areas, that would translate into substantial reductions in the share of each market using public transit.

As Table 12 indicates, these social forces interact to substantially reduce the share and, perhaps, the number of people who will consider transit as a viable option for either their work or non-work trips.

POTENTIAL MAGNITUDE OF RIDERSHIP EFFECTS

The analyses above have focused on which current market groups are likely to grow or decline and which are likely to use transit more or less because of societal trends. But the rapid growth in transit use by a very small group may have little effect on total system ridership while the slight drop in transit use of a very large group may have drastic implications. Therefore, it is important to give some idea of the dimensions of the market groups studied.

This study was not charged with analyzing historical trends in the size of various groups or in projecting the population numbers in each group into the future. Moreover, many of the groups described overlap substantially—young workers and women, those with low incomes and minorities, and so forth. However, Table 13 gives some idea of the current size of each overlapping market group and of its relative effect on current transit ridership.

Women, Blacks, Hispanics, Asians, and immigrants constitute a relatively larger share of transit riders than they do of workers. Although the analyses in Chapter 1 would appear to indicate that relationship, what they did not cover was the magnitude of the ridership effect. For example, Hispanics constituted just less than 10 percent of the U.S. workforce in 1990 but accounted for almost 17 percent of transit riders. Immigrants accounted for roughly 13 percent of the labor force but more than 27 percent of all transit riders. More than one-half of all transit riders live in households earning less than $20,000.

Table 13 shows that most current transit markets—as defined in Chapter 1—even the less traditional ones, consti-

TABLE 12 Effect of social trends on transit markets

Transit Market (Service Environments)	Number of Riders	Family Support Relationships	Household Responsibilities	Perception of Crime
Low Income (14)	Total:			-
	Share:	-	-	--
Workers with College (14)	Total:	-	-	-
	Share:	--	--	--
Hispanics (13)	Total:	--		
	Share:	---		
Workers 17-29 (12)	Total:		-	
	Share:		--	-
Women (12)	Total:	---	---	--
	Share:	---	---	---
Workers without Household Car (11)	Total:			
	Share:			
Blacks (10)	Total:			
	Share:			
Workers with Graduate School (10)	Total:		-	-
	Share:		--	--
Asians (9)	Total:	--		
	Share:	---		
Immigrants (8)	Total:			
	Share:			
Workers with Limitations (7)	Total:			--
	Share:			--
Workers 60+ (5)	Total:			--
	Share:	+		---
Workers with less than High School (5)	Total:			-
	Share:			-
Workers with some High School (3)	Total:			-
	Share:			-

tute a very large share of current transit ridership. College-educated and graduate-school-trained workers, for example, account for almost 28 percent of all metropolitan transit riders. Workers under 30 composed roughly 35 percent of all transit riders.

On the other hand, some of the more traditional, or at least more expected, transit markets, were not very important segments of current ridership. Workers over 60 and workers with mobility or work limitations, together, did not account for 10 percent of all current riders.

These numbers suggest that a relatively small increase in the number of workers in some groups—Blacks, Hispanics, immigrants, and low-income workers, for example—would have a disproportionately larger effect on transit ridership. Thus the societal trends which increase labor force participation by these groups will have a very positive effect on transit—while any trends which cause reductions in labor force participation will have very immediate and disproportionate negative effects on transit.

Continued immigration will continue to fuel transit growth as will any of the industrial trends which create low-income jobs. However, if immigration policies are changed or industrial trends reduce the total number of U.S. jobs (at any salary level), transit ridership would fall substantially.

Conversely, trends such as mandates on transport for people with disabilities, will have relatively little direct effect on transit ridership, even if both the number of such workers, and their transit share, increase remarkably (and the indirect effect may be negative).

SUMMARY OF SOCIETAL EFFECTS

Most of the societal trends analyzed work to the detriment of public transit. Many economic trends make transit less useful or even less feasible by

- Increasing trip length,
- Increasing trip variability,
- Producing non-peak and widely variable work schedules,
- Decreasing the size of individual firms, and
- Increasing suburban and even rural employment.

TABLE 13 Size and relative importance of current transit markets

Transit Markets	1990 Workers in Metropolitan Areas		Transit Use Patterns		
	Number (000)	Percentage of Total Workers	Percent Using Transit for Work Trip	Number of Transit Users (000)	Percent of Total Transit Users *
Women	36,272	45.41%	8.13%	2,948	53.74%
Blacks	8,866	11.10%	18.67%	1,653	30.13%
Hispanics (all races)	7,828	9.80%	11.88%	926	16.88%
Asians	3,035	3.80%	11.91%	361	6.58%
Workers without Household car	4,414	5.60%	45.32%	1,983	36.61%
Immigrants	10,568	13.23%	14.25%	1,506	27.46%
Workers with					
- mobility limitations	457	.57%	16.53%	76	1.38%
- work limitations	2,854	3.58%	8.57%	245	4.46%
Workers 17-29	23,883	29.90%	7.85%	1,877	34.22%
Workers 60-64	3,035	3.80%	7.36%	225	4.10%
Workers 65-69	1,358	1.70%	7.54%	105	1.92%
Workers with					
- less than High School	3,355	4.20%	13.21%	436	7.96%
- some High School	9,266	11.60%	8.58%	796	14.51%
- College Degree	13,420	16.80%	7.23%	972	17.73%
- Graduate School	7,190	9.00%	7.28%	524	9.55%
Workers with Household Income					
- under 5,000	9,346	11.70%	8.45%	790	14.39%
- $5-10,000	9,027	11.30%	8.52%	767	13.98%
- $10-15,000	10,385	13.00%	7.39%	766	13.96%
- $15-20,000	10,145	12.70%	7.14%	726	13.24%

Source: Unpublished tape readable data from the 1990 US Census, 5% PUMS
* = Percentages not additive.

Together these patterns are difficult to serve with most forms of traditional transit service. Moreover, workers may incur substantial time penalties over driving if they use transit where it is available.

Most demographic trends adversely affect transit ridership by

- Increasing the number of trips people link together,
- Increasing the need to chauffeur children and aging parents,
- Increasing the number of households with cars,
- Increasing the number of cars among current market groups, and
- Increasing low-density residential development.

Together these patterns make the car much more attractive to many users, including groups (e.g., women and older people) who are currently more dependent on public transit. Although increased immigration has increased transit ridership in some communities, immigrants are subject to the same pressures affecting most travelers; after 10 years in the United States, immigrants are less likely than average to use public transit, unless they are poor.

Most social trends only accelerate the negative effect on transit of other societal patterns by

- Increasing the obligations of working women and
- Making travelers feel unsafe while walking, waiting, or riding transit.

Most land use trends are a complement of the economic and demographic trends which act to strongly reduce transit ridership by

- Increasing low-density suburban residential development and
- Decreasing employment density.

Small land use changes, however, may provide additional riders in some communities, including the growing concentration of high-end service-sector jobs in downtowns and substantial suburban employment concentrations, like regional malls or hospitals.

Finally, it is easy to see that the strongest transport policy trends are those which further reduce transit's role and opportunities by

- Decreasing transit funding while enacting unfunded mandates and
- Focusing traffic control programs on making cleaner cars rather than forcing people to give them up.

Table 14 summarizes the likely effect on transit ridership of changes in individual travel patterns created by these major societal trends, given the current relative contribution each market group makes to total transit ridership. The dots indicate an effect in the column and row in which they appear; the size of the dot indicates our assessment of the magnitude of the effect.

In general, Table 14 suggests that overall transit ridership may increase in absolute terms among some groups, simply because the population is growing or because certain niches more likely to use transit—immigrants, for example—are increasing in number. However, these market changes may not translate into greater total ridership because the group's relative contribution is so small or the share of each group riding transit may be decreasing even as the group increases in size.

TABLE 14 Overall effect of societal trends on transit ridership

Major Societal Trends	Positive		Negative	
	Increase in Absolute Ridership	Increase in Market Share	Decrease in Absolute Ridership	Decrease in Market Share
Economic				
Industrial Restructuring		●	●	
Flexible Labor Force			●	●
Work-at-home / Telecommuting			●	●
Women's Increasing Labor Force Particpation	●			●
Growth of Service Sector Employment	●			●
Demographic				
Aging Population	●			●
Single Parent Households	●			●
Single Adult Households			●	●
Increased Suburbanization			●	●
Internal Migration			●	●
External Migration	●			●
Land Use				
Decreasing Population Density	●			●
Decreasing Employment Density			●	●
Increasing Downtown Employment Density	●	●		
Increasing Density in Older Suburbs	●	●		
Social				
Family Support Relationships			●	●
Household Responsibilities			●	●
Perception of Crime			●	●
Transportation Policy				
Decreasing Federal Funding			●	●
Relaxation of Transportation Control Mandates			●	●
Service to People with Disabilities	●	●		
Diversion of Highway Funding	●	●		

In short, the societal trends described in this report may slightly increase total transit ridership by some market groups in the near term simply because their total population is increasing and they constitute a major share of current transit riders. However, the same set of trends will generally adversely affect the percentage of those who will use transit among people already doing so—in the absence of new, different, or improved ways of delivering transit services.

Transit operators must not be lulled by any temporary improvements in ridership created by, for example, the growth of a local immigrant population. All indications are that transit's share of the immigrant market will constantly fall without a change in the way most operators do business. Transit operators must make special efforts to maintain their share of existing markets and find ways to recognize and provide appropriate transit service options to potential users.

Those already using transit more than average are an important group on which to focus efforts to increase aggregate ridership over the long run. Transit operators need to explore service options which could increase market share among groups already having a greater propensity to ride and attempt to increase ridership among groups not now dependent on transit.

CHAPTER 3

PROMISING SERVICE CONCEPTS: THEIR EFFECTS ON CURRENT AND EMERGING MARKETS

INTRODUCTION

Few societal trends maintain existing ridership or create new or expanded ridership alone—although they may alone lead to declines in ridership. But some societal trends may offer the opportunity to maintain or expand a current transit market or create a new market; in most cases, these markets can only be realized by providing new or different types of transit services.

The research team's analysis has two parts. In the first part, the research team identifies some promising transit service concepts that might be used to maintain or increase transit ridership among different market groups. In the second part of the analysis, the research team personnel identify transit operators who had implemented any of these concepts—or others—in a way which increased ridership or developed new market niches.

The first section below focuses on the kind of attributes that current and potential markets might seek from transit, matching them to promising transit service concepts. The second section describes those service concepts where sufficient ridership data existed to determine that transit ridership had increased, and among which current or potential markets. The third major section describes a preliminary assessment of the cost-effectiveness of implementing the effective options. The full case studies and descriptions of service concepts on which these analyses are based appear in Appendix E.

SERVICE ATTRIBUTES SOUGHT BY TRAVELERS

Most of the societal trends discussed in the previous chapter put transit at a distinct disadvantage, largely because they create new and different travel patterns which traditional transit options ill serve. Many travelers increasingly require transit services geared to their personal needs and to their new and varying schedules and destinations. To maintain existing markets and develop new ones, transit systems must focus on service concepts which do the following:

- Make transit faster or more direct for an individual traveler,
- Make transit more convenient for an individual traveler,
- Make transit cheaper for an individual traveler, and
- Make transit feasible and practical for an individual traveler.

Service Concepts and Traveler Needs

Table 15 lists many promising service concepts identified in the literature, widely discussed in the industry, or suggested by the TCRP Project Panel. These service concepts fall into four categories, depending on how they affect travelers.

Options which make transit faster or more direct generally work in one of six ways; they

- Give priority to transit vehicles,
- Significantly reduce the number of stops made by a transit vehicle,
- Streamline the route,
- Reduce boarding time,
- Decrease overall travel time, or
- Reduce headways and increase increase frequency of service.

Service concepts which make transit service more convenient generally involve changes to existing traditional services, that is, modifications to current fixed-route scheduled services. They generally do not overcome nontransportation barriers to transit use, such as childcare needs. These options make service more convenient in one of six major ways; they

- Make it easier to pay for service,
- Change traditional service characteristics to meet user needs,
- Adapt traditional services to changing situations,
- Bring traditional services closer to the user,
- Provide demand-responsive options, or
- Offer more alternatives for any given trip.

Service concepts making transit cheaper do so in one of two ways; they

- Directly reduce the cost of traditional services or
- Indirectly reduce the cost of less traditional services

Finally, service concepts making transit feasible and practical address the more basic problems which many people

TABLE 15 Promising transit service concepts

Making Transit Faster and More Direct	Making Transit More Convenient	Making Transit Cheaper	Making Transit Feasible
• HOV Lanes	• Route Deviation Services	• Fare Incentives	• Reverse Commute
• Busways	• Flex Routes	• Transfer Policies	• Feeder Routes
• Park and Ride Facilities	• Route Extension/Turn Back	• Vanpool / Carpool Subsidy	• Service to Large Employers / Universities
• Express/Limited Stop Service	• Late Night Request-a-Stop		• Park and Ride Facilities
• Priority Bus Traffic	• Service Routes		• Guaranteed Ride Home
• Route Restructuring	• Community Bus Service		• Childcare Facilities
• Interlining	• Downtown Loops/Circulators		• Concierge Services
• Suburb-to-suburb Service	• Neighborhood Loops / Circulators		• Travel Training Programs
• Crosstown Service	• Taxi Substitution / Jitneys		• Transit Familiarization Programs
• Suburban Transit Centers	• Public Dial-a-Ride		• Marketing and Advertising
• Facilitating Transfers	• Use of Smaller Transit Vehicles		• Joint Development
• Light Rail	• "Smart" Card / Fare Boxes		• Transit Supportive Neighborhoods
• Heavy / Commuter Rail			
• Low Floor Buses			

have in using mass transportation. Most of these problems fall into three categories: (1) they cannot travel on transit because it does not support other decisions they have made (from riding a bike to choosing a certain eldercare facility for aging parents), (2) they cannot use transit because it does not serve their destination(s), and (3) they cannot use transit because they do not know enough (or anything) about how to use it. The service concepts in this category are often mutually supportive; for example, a park-and-ride lot can be made attractive for a potential rider if childcare or concierge services are provided at the site.

The concepts in this category, then, make transit feasible and practical in five ways; they

- Facilitate bicycling and park-and-ride use;
- Work with employers to provide new transit services;
- Address nontransportation barriers to transit use;
- Provide information, education, and training on transit use; and
- Change land use patterns so transit can or does serve more destinations.

Service Attributes Sought by Current Market Groups

To maintain transit ridership among current riders in the face of societal trends or to attract new riders from groups less reliant on public transit, it is necessary to adopt specific service concepts that meet the actual needs of current or potential riders. Table 16 suggests how individual service concepts might respond to the needs of the market groups identified in Chapter 1.

Women

Women, as a group more likely to use public transit for both work and non-work trips, require both new transit services and various nontransportation services to even maintain their current ridership patterns. Many women are service workers who will require direct service to large employers and feeder routes to and from their work site that connect with existing services. These transit services must be matched to their work schedules, which are often not in the traditional hours. In addition, many women will require services that address their domestic concerns—childcare at transit stations (or near the work site), guaranteed-ride-home programs to allow them to attend to ill children or parents if they take transit to work, and concierge services (e.g., dry cleaning, postal services, and banking).

Female workers will require transit concepts reflecting the suburban or low-density character of either their origin or destination, their concerns about personal security, and the nontraditional times at which they may commute. Transit concepts which will extend or deviate to their homes or the

TABLE 16 Promising service concepts matched to current market groups

	POTENTIAL SERVICE OPTIONS BY TYPE OF TRIPS	
	WORK TRIPS	NON-WORK TRIPS
WOMEN		
FEASIBLE	• Service to Large Employers • Reverse Commute • Childcare Facilities • Concierge Service • Guaranteed Ride Home • Joint Development	• Transit Supportive Neighborhood • Joint Development
MORE CONVENIENT	• Feeder Routes	
FASTER AND MORE DIRECT	• Route Deviation • Flex Routes • Route Extension • Night Request Stops • Downtown Loops • SmartCard/Fare Boxes • Low Floor Buses	• Community Bus Service • Taxi Substitution • Advanced DAR • Neighborhood Loops • Smaller Transit Vehicles • Low Floor Buses
	• Priority Bus Traffic • Route Restructuring • Suburban Transit Centers • Facilitating Transfers	• Suburban Transit Centers • Route Restructuring
PEOPLE WITHOUT CARS; HOUSEHOLD INCOME <$15,000		
FEASIBLE	• Feeder Routes • Reverse Commute • Service to Large Employers • Joint Development • Concierge Service • Marketing and Advertising	• Transit Supportive Neighborhood • Joint Development • Marketing and Advertising
MORE CONVENIENT	• Route Deviation • Flex Routes • Downtown Loops	• Taxi Substitution • Service Routes • Community Bus Service • Neighborhood Loops
FASTER AND MORE DIRECT	• Route Restructuring • Facilitating Transfers • Suburban Transit Centers • Priority Bus Traffic • Bus Ways	• Suburban Transit Centers • Facilitating Transfers • Route Restructuring
CHEAPER	• Fare Incentives • Vanpool/Carpool Subsidy • Transfer Policies	• Fare Incentives • Transfer Policies
BLACK; HISPANIC; ASIAN		
FEASIBLE	• Reverse Commute • Service to Large Employers • Feeder Routes • Joint Development	• Transit Supportive Neighborhood • Joint Development

(*continued on next page*)

TABLE 16 (*continued*)

	POTENTIAL SERVICE OPTIONS BY TYPE OF TRIPS	
	WORK TRIPS	NON-WORK TRIPS
BLACK; HISPANIC; ASIAN (continued)		
MORE CONVENIENT		
	• Route Deviation • Feeder Routes • Downtown Loops • Flex Routes • Night Request Stop	• Neighborhood Loops • Community Bus Service
CHEAPER		
	• Fare Incentives • Vanpool/Carpool Subsidy • Transfer Policies	• Fare Incentives • Transfer Policies
COLLEGE AND GRADUATE SCHOOL ED.		
MORE CONVENIENT		
	• Flex Routes • Late Night Request Stop • Smaller Transit Vehicles • Advanced DAR • Route Extension • Downtown Loops	• Taxi Substitution • Community Bus Service • Smaller Transit Vehicles
FASTER AND MORE DIRECT		
	• HOV Lanes • Express/Limited Stops • Route Restructuring • Priority Bus Traffic • Light Rail • Low Floor Buses	• Suburban Transit Center • Low Floor Buses • Priority Bus Service
FEASIBLE		
	• Service to Large Employers • Park and Ride Facilities • Feeder Routes • Joint Development • Concierge Service • Childcare Facilities • Guaranteed Ride Home	• Transit Supportive Neighborhood • Joint Development
PEOPLE 17-29; HIGH SCHOOL		
FEASIBLE		
	• Feeder Routes • Service to Large Employers • Park and Ride Facilities • Joint Development • Marketing and Advertising	• Transit Supportive Neighborhood • Joint Development
FASTER AND MORE DIRECT		
	• Route Restructuring • Facilitating Transfer • Suburban Transit Center • Express/Limited Stops • Bus Ways	• Suburban Transit Center
CONVENIENT		
	• Route Deviation • Feeder Routes • Flex Routes • Downtown Loops • Night Request Stop	• Neighborhood Loops • Community Bus Service

(*continued on next page*)

TABLE 16 (*continued*)

	Potential Service Options by Type of Trips	
	WORK TRIPS	NON-WORK TRIPS
IMMIGRANTS		
FEASIBLE	• Service to Large Employers • Feeder Routes • Reverse Commute • Park and Ride Facilities • Joint Development • Marketing and Advertising	• Transit Supportive Neighborhood • Joint Development
CHEAPER	• Fare Incentives • Transfer Policies • Vanpool/Carpool Subsidy	• Fare Incentives • Transfer Policies
FASTER AND MORE DIRECT	• HOV Lanes • Route Restructuring • Express/Limited Stops • Facilitating Transfers • Priority Bus Traffic	• Route Restructuring • Facilitating Transfers
PEOPLE 65+		
FEASIBLE	• Park and Ride Facilities • Feeder Routes • Transit Supportive Neighborhood	• Travel Training Program • Transit Familiarization • Transit Supportive Neighborhoods • Marketing and Advertising
FASTER AND MORE DIRECT	• Priority Bus Traffic • Low Floor Buses • Suburban Transit Centers • Route Restructuring	• Low Floor Buses • Facilitating Transfers • Route Restructuring • Suburban Transit Centers • Priority Bus Traffic
MORE CONVENIENT	• Route Deviation • Route Extension • Flex Routes • Smaller Transit Vehicles • Downtown Loops • Community Bus Service	• Smaller Transit Vehicles • Community Bus Service • Service Routes • Taxi Substitution • Advanced DAR • Neighborhood Loops

door of the firm at which they work, particularly late at night, might induce more women to use transit while holding on to current riders. Concepts which enable working women to do mid-day shopping—such as downtown circulators—might maintain current market share.

Transit concepts which increase the speed and the ease of their trip will positively affect working women. The destinations of many service workers of both sexes are not well served by traditional routes focused on the historic downtown or those focused only on a few large employers. With route restructuring, a system may be able to better serve suburban destinations and less concentrated employment sites while making the system easier to understand and use. Although transit use drops sharply when people are forced to transfer, some of this loss among women can be prevented by better synchronizing transfers and by providing safe and sheltered places—such as suburban transit centers—in which to transfer.

People Without Cars; People With Low Incomes

Because they overlap with women and with one another—people without cars and those with household income below $15,000 need services with similar attributes. Services which provide more direct access to their work sites or address their

domestic needs might maintain ridership among these groups. More convenient services—route deviation and flex routes—might serve additional destinations and increase ridership.

But there are also differences. Many low-income and carless workers may live in or near the central core of the city but commute to suburban areas. Although some of this "reverse commuting" is very short—just over the border of the central city to a close-in suburb, much of it is quite lengthy travel to suburban employment complexes such as hotels, medical centers, and malls. These patterns can be seen in the Census data on low-income workers, particularly women. Feasible service for such workers would be relatively direct reverse-commute services, feeder services, or both from suburban transit stops and stations to their actual employment sites.

Such workers might also require additional or targeted service information. Marketing and advertising services—in conjunction with the other service improvements geared to desired attributes—might also increase or maintain ridership among low-income and carless households for both work and non-work trips.

Low-income and carless travelers tend to be more responsive to transit fare levels than other travelers. Fare reductions and free transfer options might maintain their transit use despite societal trends encouraging them to use the car. In addition, some of these workers might be induced to use a subsidized vanpool.

Blacks, Hispanics, and Asians

Ethnic and racial minorities—Blacks, Hispanics, and Asians—are substantially more likely to use transit, even when controlling for income. Many of the transit concepts previously discussed (e.g., reverse-commute, services to large employers, various route deviation and flex services, and fare incentives) would meet the service attributes required by these travelers.

However, Hispanic and Asian populations are becoming more concentrated in older suburbs and may present special challenges to transit operators; route restructuring might better meet their transit needs. In addition, Hispanics are substantially more likely to carpool than other ethnic groups; subsidized vanpools may meet even more of their needs.

Travelers with College and Graduate School Training

One of the more surprising groups disproportionately dependent on transit are those with a college degree and some graduate school training. These travelers seem particularly well served by transit concepts which personalize efforts or provide a higher level of service, particularly providing direct service to their employers and offering various deviation and flex services. In addition, such riders may be more sensitive to time and speed, as well as the ease of using a system; route restructuring (which often makes service more rational), park-and-ride, express buses, and high-occupancy vehicle (HOV) lanes may all provide the kind of service attributes which such travelers require. Riders with higher educational attainments have also been disproportionately more likely to use light rail and commuter rail services. These travelers are also over-represented in downtown circulator and loop systems, suggesting that they need mobility in mid-day for shopping, eating, and personal business.

Young Workers and Workers With High School Degrees

Table 16 shows that two additional groups of travelers—people 17 to 29 and people with a high school degree—also overlap significantly with most of the market niches already discussed. As such, many of the same transit concepts will provide the service attributes they seek: direct services to employers, flexible and route deviation services, and express services. At the same time, these groups will be slightly more responsive to cost attributes and may be very responsive to fare incentives, relaxed transfer policies, and subsidized van and carpools.

Immigrants

Immigrants are a very important group because they remain more likely to use transit, even after years in the United States and even when their income increases substantially. They overlap substantially with groups already discussed—those under 30, those with low incomes, those with no cars, and Hispanics and Asians. As such, most of the service concepts previously discussed will provide the service attributes such travelers seek. However, it may be very important for transit systems to target and market these service concepts to the actual origins and destinations and schedules of immigrant workers, rather than assuming such workers will continue to support the current services offered.

Older Workers

Finally, Table 16 suggests that, although people over 65 are more likely to use transit for work and non-work trips, the market share among this market niche is falling in most service environments. On the other hand, elderly people are very responsive to certain service concepts, at least for non-work trips. Those that provide some of the convenience and safety of the car—like taxis and demand-responsive services—are very attractive to such users. However, elderly travelers have also been drawn to customized but regular transit concepts such as service routes, community buses, and deviation services of several types.

Service Attributes Sought by New or Expanding Market Groups

Table 17 focuses on groups less dependent on public transit but who are often thought to be "captive riders" because of their personal characteristics or who could be transit riders if given the correct service concepts. This set of travelers includes

- Women with incomes below $10,000,
- People with some high school education (no degree),
- People age 50 to 59 with incomes below $20,000,
- People with no high school education,
- People with some college education (no degree),
- People with incomes between $20,000 and $40,000,
- Children age 12 to 16, and
- People with one household car (in 2+ person households).

Women with low incomes are a group routinely assumed to depend disproportionately on public transit. In fact, such women are more likely to drive than men with low incomes or than women making more money, probably because women with low incomes have multiple domestic obligations and face the suburbanization of so many job opportunities. Women with low incomes share the need for transit service geared to suburban as well as central city employment concentrations with other groups erroneously thought to be more dependent than average on transit—people with some high school, people with less than a high school education, and people 50 to 59 with incomes less than $20,000.

All of these potential market groups would be better served by direct routes to large employers, by appropriately scheduled and provided reverse-commute services (direct bus lines, for example, rather than feeders to and from suburban terminals), and by route restructuring with service focused on new development and employment patterns. These could be provided in regular buses or in van pools.

Given the suburban locations of so many jobs, as well as the early morning and late night shifts they often work, these four groups of people might respond to optional route extensions, flex routes, and route deviation services. Female workers in these market niches might find childcare and concierge services to be very important to their modal choices. All four groups would be responsive to fare incentives, but probably only if provided in conjunction with one or more of the other service concepts relevant to their needs.

Table 17 also focuses on potential market niches of those living in a household with at least one car, people with some college education, and people with moderate household income ($25,000 to $40,000 per year). These people will also be relatively unmoved by fare incentives but may be very responsive to services targeted directly to their employers as well as services which save them time, like HOV lanes or priority transit treatments. Route restructuring concepts (e.g., crosstown services and suburban services) may also increase both the speed and the convenience of transit for these travelers. They may be even more responsive to flexibility in service delivery—guaranteed-ride-home programs, flex routes and route extensions, and route deviation services.

Finally, Table 17 highlights a group which is a heavy user of transit service in other countries—school children 12 to 16. To gain additional ridership from these travelers, transit systems will have to satisfy the young riders themselves and their parents. This group is known to be extremely responsive to fare incentives and special passes; moreover, given the neighborhood base of most school and other trips, they would be well served by flexible and demand-responsive services.

Transit systems may also gain substantial ridership from these travelers by rerouting buses to serve schools, rescheduling buses to coordinate with school opening and closing times, and working with school districts on pass programs. To the extent that such services reduced parents' worries about security and so forth, they would help create additional ridership; such programs are likely to increase ridership for nonschool activities as well.

EFFECTIVE SERVICE CONCEPTS

In the second part of the analysis described in this chapter, the research team interviewed many transit operators who had increased transit ridership, were known to be implementing some of the promising service concepts identified above, or both.

To identify operators who might have captured new markets or expanded existing ones, the research team used Section 15 data to identify communities with significant increases in ridership, effectiveness, or cost effectiveness in 19 different service environments. Specifically, the research team identified transit systems in communities of different sizes and population densities

- Having the greatest change in ridership per revenue vehicle hour (PRVH), 1989–93;
- Achieving the highest ridership PRVH in 1993;
- Displaying the lowest costs per passenger mile in 1993, or,
- Experiencing the lowest cost per passenger in 1993.

The Section 15 calculations appear in Appendix D.

These calculations were used to select 17 sites for detailed case studies. Eight sites were chosen for either having increasing PRVH over a 5-year period or high PRVH in 1993; nine sites were chosen on the basis of one or more of the other Section 15 cost or effectiveness measures, alone or in combination with high hourly ridership. An additional 5 sites were studied on the recommendation of research team or panel members.

The research team developed a list of data sought of each site and obtained that in several lengthy phone interviews. To

TABLE 17 Promising service concepts matched to potential transit markets

	Potential Service Options by Type of Trips	
	WORK TRIPS	**NON-WORK TRIPS**
WOMEN WITH INCOME <$10,000; PEOPLE WITH SOME HIGH SCHOOL		
PEOPLE 50-59 WITH INCOMES <$20,000		
PEOPLE WITH LESS THAN H.S. EDUCATION		
Feasible		
Faster and More Direct	• Service to Large Employers • Reverse Commute • Feeder Routes • Child Care Facilities • Concierge Service	• Transit Supportive Neighborhood • Joint Development • Marketing and Advertising
Cheaper	• Route Restructuring • Facilitating Transfers • Suburban Transit Centers • Priority Bus Traffic	• Suburban Transit Center • Facilitating Transfers • Route Restructuring
More Convenient	• Fare Incentives • Vanpool/Carpool Subsidies • Transfer Policies	• Fare Incentives
	• Route Deviation • Flex Routes • Downtown Loops • Feeder Routes • Route Extension	• Neighborhood Loops • Route Deviation
HOUSEHOLD WITH ONE CAR; PEOPLE WITH SOME COLLEGE		
HOUSEHOLD INCOMES $25,000 - $40,000		
Feasible		
More Convenient	• Service to Large Employers • Feeder Routes • Joint Development • Concierge Service • Guaranteed Ride Home	• Transit Supportive Neighborhood • Joint Development
Faster and More Direct	• Flex Routes • Late Night Request Stop • Smaller Transit Vehicles • Route Extension • Downtown Loops	• Smaller Transit Vehicles • Taxi Substitution • Community Bus Service • Neighborhood Loops • General Public DAR
	• HOV Lanes • Route Restructuring • Park and Ride • Low Floor Buses • Priority Bus Traffic	• Priority Bus Traffic • Suburban Transit Center • Low Floor Buses
CHILDREN 12-16		
Feasible	School	
Faster and More Direct	• Transit Supportive Neighborhood • Marketing and Advertising	• Transit Supportive Neighborhood • Marketing and Advertising
Cheaper	• Route Restructuring • Facilitate Transfers	• Route Restructuring • Facilitating
More Convenient	• Fare Incentives • Transfer Policies	• Fare Incentives • Transfer Policies
	• Flex Routes • Neighborhood Routes • Route Extension • General Public DAR	• Flex Routes • Neighborhood Loops • Route Extension • General Public DAR

ensure the accuracy of reporting, the research team submitted each case study to each of the officials to whom the research team personnel spoke, asking them to verify the data and descriptions. The full case studies appear in Appendix E.

In addition, the research team identified some transit systems implementing service concepts thought to be able to maintain or increase transit markets. Because not all promising concepts were represented in the 23 detailed case studies, the research team contacted more than 40 systems experimenting with one or more specific service concepts to determine their ridership experiences. Information from the 40 additional interviews is given in this chapter and in Appendix G, which contains the full details of service options implemented.

However, obtaining disaggregated data on transit ridership at the system level was not easy. Most transit operators do not obtain ridership data at the level of detail the research team sought; they rarely collect data on age or sex or income of their riders, let alone race, ethnicity, or immigration status. So, although operators often had an idea of who they were serving, they could rarely state definitively which riders contributed to any particular service's success.

As a result of these problems, the research team often could not get very detailed assessments of ridership or ridership linked to service concepts. At the same time, many systems had destination-specific information; they knew that services provided to a suburban mall or a university had high ridership, although they rarely knew whether their riders were going shopping or to work, were young or old, or were male or female.

Operational Patterns Reported by Transit Operators

Table 18 details the kinds of operational patterns which transit systems reported as effective in increasing ridership. Some systems found that shopping malls, large employers (such as public agencies), hospitals, and universities provided a useful destination on which to focus transit services; there are indications that such sites offered both work and nonwork destinations.

Systems in several service environments reported increased ridership for special events like conventions and football and baseball games. In some cases, the transit system had supplied additional or special services; in other cases, they simply noticed that ridership increased. Several systems, such as Broward, Tucson, and Phoenix, reported that ridership increased substantially during the winter months when local populations swelled with "snow birds." Other systems reported that ridership increased when weather was very bad or when there were smog and ozone alerts.

TABLE 18 Transit markets reported by transit operators

Service Environments	Work Trip	Non-Work Trip	Destinations	Special Circumstances
50,000 - 500,000				
• *very low density*	University Faculty and Staff			
• *low density*	University Faculty and Staff	University Students Disabled Travelers Preschool and School Children	Large Employers/ Universities	Sporting Events
• *medium density*				
• *high density*				
500,000 - 1 million				
• *low density*	University Faculty and Staff	University Students; Families; Single Parents; School Age Children; Riders 70+ Years Old; Disabled Riders	Social Service Agencies Shopping Malls Large Employers/ Universities Industrial Sites; Grocery Stores	Winter Visitors / "Snowbirds" Sporting Events
• *medium density*		Public School Students	Shopping Malls	Poor Weather Conditions
• *high density*				
Over 1 million				
• *low density*	University Faculty and Staff	Tourists; School Age Children; University Students; Disabled Riders 70+ Years Old	Large Employers/ Universities; Shopping Malls; Social Service Agencies; Military Bases	Winter Visitors/ "Snowbirds" Sporting Events
• *medium density*	Hospital Employees University Faculty and Staff	Tourists; Disabled Riders; Riders 70+ Years Old University Students	Senior Centers; Universities; Hospitals/ Medical Centers Trailer Parks Regional Shopping Centers	Conventioneers
• *high density*	University Faculty and Staff	University Students; Tourists	Hospitals; Larger Employers; Beaches	"Accidental" Reverse Commuters

A subset of properties reported increased ridership by the elderly and those with disabilities. In some cases, this was a response to accessible buses or special marketing or training programs; in other cases it seemed to be occurring in the absence of special measures. Several systems reported increasing ridership among school children—in some cases, this was the result of school districts ending their own transportation programs; in other cases, it was the result of conscious service decisions targeting school children.

Summary of Ridership Experiences

Roughly 75 percent of the systems or services the research team described above had some ridership information; roughly 40 percent had data about ridership trends over time. Only a handful of systems provided the kind of sociodemographic data needed to determine which of the promising service concepts could maintain or increase ridership or create new markets from among the market groups identified in Chapter 1.

Transit operators have useful ridership data—their own operational needs require them to characterize and, to a lesser extent, measure their ridership, in terms of location or direction of service, time of service, frequency of service, and the kind of trip they are serving. Although such information is useful in addressing operational concerns, except for a few service concepts and market niches, this information was not particularly useful for the types of analyses performed for this study.

On the basis of the case studies and contact with approximately 40 additional transit systems, the research team concluded that 13 transit service concepts increased total transit system ridership as follows:

- Feeder services,
- Express buses,
- Services to large employers,
- Reverse-commute services,
- Vanpool incentives,
- Park-and-ride services,
- Fare incentives,
- Travel training and transit familiarization,
- Light rail,
- Commuter rail,
- Route restructuring,
- Community buses and service routes, and
- Special event services.

That is, these service concepts did more than show positive ridership increases; their overall effect on the system was positive—new ridership did not (all) come from existing services or routes. The magnitude of ridership response varied greatly (as did the inputs required to achieve that response). Moreover, not all of these services increased system ridership in every service environment or every application; both reverse-commute and targeted employer services, for example, were sometimes very effective and other times not.

These ridership increases were usually found in the following six operational patterns:

- Suburb to suburb,
- Service to large suburban trip generators,
- Central city to suburb,
- Special sporting and recreational events,
- Suburb to central city, and
- Service to universities (generally suburban campuses).

Given the limited information which transit systems could provide, the research team also knows some of the markets which were expanded, often significantly, by the implementation of a series of these service concepts. These market niches include

- People with disabilities,
- People age 17 to 25 (particularly university students),
- Children age 5 to 12,
- Blacks (particularly inner-city residents),
- Hispanics (particularly inner-city residents),
- Immigrants,
- People age 65 and older,
- People with high incomes,
- People age 50 and older, and
- Men.

People with disabilities have been induced to make greater use of fixed-route transit, generally using the total system more than when they were paratransit users (if they were) by the provision of passes or free fares, travel training, vanpool incentives, downtown and neighborhood circulators, general public dial-a-ride (DAR), and smaller buses.

Young people (age 17 to 25), particularly those who are university students, were an important market in many service environments when provided with free or fare-free passes, restructured services (i.e., better routing, scheduling, timed transfers, and suburban transfer stations), and feeder or shuttle services from rail and regional bus.

School children (age 12 to 16 and even age 5 to 12) are a growing market in some service environments; they have been attracted to transit by the provision of free or fare free passes, transit familiarization programs, general public DAR, and restructured services.

Blacks and Hispanics, particularly those with low incomes and living in the inner city, have expanded their use of transit when provided with direct service to suburban and central city employers, reverse-commute services—direct and feeder, and vanpool incentives.

Immigrants, a market niche overlapping with Hispanics, were very responsive to service concepts which focused on employment locations, including reverse-commute options and direct employer services.

People over 65 have helped systems increase total ridership when offered passes and discount fares, transit familiarization sessions, general public DAR, low-floor buses, and smaller buses. Older people who are members of racial or ethnic minorities have also been attracted by jitneys.

Men, those with high incomes, and those age 50 and older were attracted to several service concepts including light and heavy rail services.

Although the research team has little evidence that those with higher educational attainment were also attracted by some of these service concepts, it is likely. In fact, the case studies suggest some reasons for greater relative reliance on transit among those with college and graduate school education. The case studies found that many transit systems had substantial success in providing one or more transit service concepts—from fare concessions to express services to route restructuring—to universities, large private employers, and large public agencies.

Such large organizations often put a high value on reducing drive-alone commutes and were willing to subsidize transit ridership or pass costs in an effort to do so. Some also substantially restricted parking, for environmental reasons or space constraints or policy mandates (e.g., no student parking). Ultimately these kind of programs may have effectively targeted more highly educated workers.

Overall, these analyses, and their findings, may be seriously constrained by the lack of data. Other service concepts may have been effective in increasing transit ridership and/or other market niches may have been expanded—the research team simply has no data which prove this.

Table 19 describes the research team's educated assessments of each service concept's

- Overall effect on service ridership,
- Diversionary effects,
- Effect on total system ridership,
- Work and non-work ridership characteristics, and
- Special O-D characteristics which might bear on ridership.

The first column of Table 19 summarizes the effect on ridership, of the actual service concept—that is, increased feeder route or vanpool ridership. Of course, some concepts, such as travel training, are not themselves services. The second column of the table describes what the research team knows about how much a new service gained ridership at the expense of other routes or services. This is not always negative—some systems are searching for ways to divert riders from ADA-mandated paratransit to fixed-route services; others may be seeking to reduce their peak-period load.

The third column details whether a service which itself attained new ridership actually contributed to total system ridership (e.g., if a feeder service increased ridership on the rail or bus system it was feeding) and whether the net effect on ridership was positive (i.e., if there were ridership gains when diversions were subtracted from ridership increases on the new service). Of course, even services which divert some riders from other routes or modes can still increase total system ridership.

The fourth column of Table 19 identifies the market niche(s) actually accounting for the ridership increases on the service itself or the system overall. As suggested by both the previous section of this report, and the discussion above, the research team does not know a great deal about who accounts for most ridership gains. Transit systems typically have considerable information about elderly riders and riders with disabilities—largely because the costs of providing ADA-related paratransit services have encouraged transit operators to find ways to divert paratransit riders to fixed-route services.

The fifth column on Table 19 describes special O-D patterns or special trip characteristics, which define or explain the service concept's effectiveness in increasing ridership. Often this kind of information was the only ridership data which transit systems could provide.

Research team personnel were very limited by how little information operators were able to provide. This report only indicates that a service concept increases ridership if the research team obtained operational data showing that it did so. In addition, this approach slights promising concepts which have not yet reached their potential (e.g., joint developments or transit-supportive neighborhoods), those where it is hard to separate out or measure the effects on ridership (e.g., marketing and advertising), or those the research team did not uncover in the literature search, the case studies, or additional interviews.

PRELIMINARY ASSESSMENT OF COST EFFECTIVENESS

Some transit service concepts increase ridership at a very high cost; others do so relatively cheaply. This study was not charged with evaluating the costs of providing each option—it would have been extremely difficult to do so, because most systems had few cost details—however, the research team does provide a preliminary assessment of the relative short- and long-term costs of each service concept using a simple, qualitative scale.

Table 20 compares the capital and operating costs for each new trip gained for a transit system by each transit service concept, both initially and over time. Low costs are those roughly equivalent to the average cost of providing peak-period bus service. Although some authorities would not find these costs to be low, they do suggest the relative costs to a system from implementing one of the options either in addition to, or instead of, current bus services. Very low costs are those which are less than average peak-period bus service costs.

Moderate costs are those up to 50 percent greater than unit costs for peak-period bus service; high costs are those up to

TABLE 19 Effective service concepts; effect on ridership

	INCREASED RIDERSHIP			MARKET NICHE SERVED		
	Service Itself	Without Drawing Riders from other Transit	System-Wide	Work	Non-Work	Destination/ Events
FARE INCENTIVES	N.A.	Yes	Yes	Work Not fully known • Colleges and Graduate School • People with Disabilities School • People 17-29 • Children 6-16	• People 65+ • People 17-29 • Children (5+) • People with Household Incomes < $15,000 • People with Disabilities	• Special Events • Universities • Schools • Tourist Sites
FEEDER ROUTES	Yes	Possible Diversion	Yes	• Women • People 17-44 • People with Household Incomes < $25,000 • People with Household Incomes > $50,000	• Women • People 17-44 • People with Household Incomes < $25,000 • People with Household Income s> $50,000	• Special Events
HEAVY / COMMUTER RAIL	Yes	Some Diversion	Yes	Not Fully Known: • High Income Workers • People 50+		
LIGHT RAIL	Yes	Some Diversion	Yes	Not Fully Known: • High Income Workers • People 50+	Not Fully Known: • High Income Workers • People 50+	
LOW FLOOR BUSES	Possible	Possible	Possible	Unknown	Unknown	
REVERSE COMMUTE	Yes	Possible Diversion	Yes	• People 17-44 • People with Household Incomes > $15,000 • College and Graduate School Edcuation • High Income • Women with Household Incomes < $20,000 • Blacks • Immigrants • Hispanics		• Medical Complexes • Hotels • Malls • Employment Complexes
ROUTE RESTRUCTURING PACKAGE	Yes	Yes	Yes	Unknown	Unknown	• Suburban Medical Complexes • Universities • Suburban Employ-ment Sites
ROUTE RESTRUCTURING CONCEPTS						
CROSS TOWN BUSES	Yes	Possible Diversion	Yes	Largely Unknown: • People 17-29 • People with Low Income • Blacks • Hispanics	Unknown	• Suburban Attractors
SUBURB - TO - SUBURB SERVICE	Yes	Yes	Yes	Largely Unknown: • People 17-29 • People with Low Income • Blacks • Hispanics	Unknown	• Suburban Attractors

(continued on next page)

TABLE 19 (*continued*)

	INCREASED RIDERSHIP			MARKET NICHE SERVED		
	Service Itself	Without Drawing Riders from other Transit	System-Wide	Work	Non-Work	Destination/ Events
ROUTE RESTRUCTURING CONCEPTS (continued)						
SUBURBAN TIMED TRANSFER CENTERS	Yes	Yes	Yes	Unknown	Unknown	• Universities
SERVICE TO LARGE EMPLOYERS ETC.	Yes	Yes	Yes	School • People 17-24 Work High Income Workers Highly Educated Workers		•Universities • Schools • Medical Complexes • Individual Employers • Malls
SERVICE ROUTES / COMMUNITY BUSES	Yes	Desirable Diversion from Paratransit Services	Yes		• People 65+ • People with Disabilities	
SMALLER TRANSIT VEHICLES	Yes	Yes	Yes	Unknown	Unknown	
TRAVEL TRAINING	N.A.	Desirable Diversion from Paratransit Services	Yes	• People with Disabilities	• People with Disabilities	
TRANSIT FAMILIARIZATION	N.A.	No	Yes	• People 65+ • People with Disabilities • Children 12-17	• People 65+ • People with Disabilities • Children 12-17	
VANPOOL INCENTIVES	Yes	Possible	Yes	• People with Low Incomes • Blacks • People with Moderate and High Incomes • People with Disabilities		• Reverse Commute Flows • Medical Complexes • Suburban Empolyers

100 percent greater than peak-period bus service unit costs. Very high costs are those more than 100 percent greater than current peak-period bus service costs per passenger.

These are rough measures; unit bus costs for both "traditional" peak-period services and those service concepts considered here will vary substantially with ridership. Capital (and sometimes operating) differentials will depend on whether these service concepts are provided in addition to or instead of traditional bus service—thus determining whether new equipment and facilities are needed or whether existing resources can be used.

Moreover, some of the service concepts are not designed to be provided during peak periods, so the comparison may not be relevant. Some service concepts may have a greater fare recovery than others or than traditional bus service—including express buses and service to special attractions and sporting events (where riders are willing to pay higher than average fares as long as they are less than parking costs, private sponsors may cover some of the operating costs, or both).

In addition, the actual cost ranges may be significant. Building a new rail system or expanding an existing one is remarkably more expensive than adding new bus service. Thus capital-intensive options such as light and commuter rail are initially enormously more expensive per new trip than are other options; however, if they continue to attract new riders, their average unit costs might drop substantially.

TABLE 20 Preliminary cost-effectiveness of successful service concepts

Successful Service Concepts	Estimated Cost Per Net New Trip					
	Initially			Long -Term		
	Capital	*Operating*	Total	*Capital*	*Operating*	Total
Feeder Services	None to Low	Low to Moderate	**Low**	Low	Low to Moderate	**Low**
Services to Large Employers	None to Low	Low to Moderate	**Low to Moderate**	Low	Low to Moderate	**Low to Moderate**
Express Buses	None to Low	Moderate	**Low to Moderate**	Low	Moderate	**Moderate**
Reverse Commute Services	None to Low	Low	**Low**	Low	Low	**Low**
Vanpool Incentives	Low to Moderate	Very Low to Low	**Low**	Low to Moderate	Very Low	**Low**
Fare Incentives	N.A.	None to Low	**Very Low to Low**	N.A.	Very Low to Low	**Low**
Park-n-Ride	Moderate to High	Moderate	**Moderate to High**	Low	Moderate	**Moderate**
Travel Training	N.A.	Low to Moderate	**Low**	N.A.	Low	**Low**
Route Restructuring	None to Low	None to Low	**Low**	Low	Low	**Low**
Community Buses	Moderate	Low to Moderate	**Moderate**	Moderate	Low to Moderate	**Moderate**
Special Events	Low to Moderate	Low	**Low**	Low	Low	**Low**
Commuter Rail	Very High	High to Very High	**Very High**	Low to Moderate	High	**Moderate to High**
Light Rail	High to Very High	High to Very High	**High to Very High**	Low to Moderate	Moderate to High	**Moderate to High**

Note: Compared to average peak period bus service unit costs.

In fact, even though the scale is very different, the long-term costs of even bus-based concepts could well depend on whether they continued to increase ridership. Travel training programs, for example, are very cheap if riders with disabilities continue to use fixed-route service in preference to complementary paratransit; however, if trained passengers immediately stop riding regular buses (or require continual re-training), average costs per trip would be moderate rather than very low.

Moreover, the cost of some concepts is linked to actual rider characteristics. Some fare incentives increase net ridership without almost any cost—for example, offering lower fares to older people in the off-peak rarely affects existing ridership. Providing cut-rate monthly transit passes can be costly if some current riders who are paying full fare buy the reduced rate passes—even if total net ridership increases. Finally, some or all of these concepts could be implemented together which might substantially raise total cost, initially and over time—but also substantially increase overall ridership counts, perhaps above that which could be achieved by any single concept alone.

The assessments shown in Table 20 are a first attempt at providing a way for transit systems to evaluate the relative costs of promising options—if they keep in mind all the oper-

ational details which determine both the initial and long-term costs of current service options and promising options.

SUMMARY

Thirteen service concepts have been shown as effective in increasing transit ridership—most in several service environments. These concepts are as follows:

- Feeder services,
- Express buses,
- Services to large employers,
- Reverse-commute services,
- Vanpool incentives,
- Park-and-ride services,
- Fare incentives,
- Travel training and transit familiarization,
- Light rail,
- Commuter rail,
- Route restructuring,
- Community buses and service routes, and
- Special event services.

The ridership increases linked to these effective concepts occurred in the following 10 transit niches and markets:

- People with disabilities,
- People age 17 to 25 (particularly university students),
- Children age 5 to 12,
- Blacks (particularly inner-city residents),
- Hispanics,
- Immigrants,
- People age 65 and older,
- People with high incomes,
- People age 50 and older, and
- Men.

Although the success of the 13 service concepts is probably not limited to these 10 niches, they are, however, the only ones on which the research team has ridership data.

The preliminary cost-effectiveness assessments suggest that some of the effective concepts are often relatively inexpensive to implement in many cases (e.g., travel training, vanpool incentives, reverse commute, and route restructuring). Others are very expensive per ride and should be carefully considered before being implemented as a way to target new markets.

These analyses have been severely hampered by the lack of good ridership data. Many systems indicated that other service concepts had been successful in increasing ridership but they had no evidence to document those increases, let alone data on the sociodemographic characteristics of riders gained. Other transit operators indicated that some service concepts not listed here had been effective in creating a positive image for transit or in laying the groundwork for ridership increases in the future. Again, lacking ridership data, the research team could not determine whether or not those concepts were effective.

CHAPTER 4

SOCIETAL EFFECTS OF IMPLEMENTING PROMISING SERVICE CONCEPTS

INTRODUCTION

The research team was charged with examining the overall societal effects of providing the service concepts described in Chapter 3. Most transit services are subsidized because policymakers recognize them as an important governmental function—transit can increase the access and mobility of many groups while encouraging others to drive less. Those who use buses, subways, and trains benefit society as well as themselves. The potential benefits of transit use range from reduced congestion and pollution to decreased medical and welfare costs.

The direction of the societal effects arising from implementing any of the transit concepts is clear—it would be positive; however the effective service concepts identified in the previous chapter do not offer the same degree of mobility to all travelers and would not have the same effect on the travel patterns of all market groups. Providing an attractive transit service to a suburban worker with multiple household cars may not have the same overall effect as providing a service which allows a low-income worker to get to a suburban job. Thus, the magnitude of societal changes is far less clear.

To complicate matters, the 13 service concepts shown to be effective in increasing or maintaining ridership have widely varying costs per average rider and per new rider. It is very expensive to provide commuter rail services which attract high-income male workers but relatively inexpensive to provide services targeted to specific large employers serving low- and moderate-income workers. So, even less clear is the cost-to-benefit ratio of the effective service concepts, even if measured only in qualitative terms and only for aggregate societal benefits.

Finally, given that most new transit services come at the expense of other transit services, many users are in competition with one another (whether they know it or not) for concepts which better meet their needs. Moreover, transit service ultimately comes at the cost of other public programs ranging from parks to pre-natal health care—providing one type of service may prevent an operator from providing others, creating what economists call opportunity costs. These opportunity costs must be considered in the assessment of societal benefits.

The following section considers the total effect on ridership of implementing various service concepts; this analysis is the basis for subsequent work. The second section presents an overview of the equity and effectiveness of each service concept. The research team uses these assessments to give some idea of the relative magnitude of societal benefits offered by each service concept.

MAGNITUDE OF RIDERSHIP EFFECTS

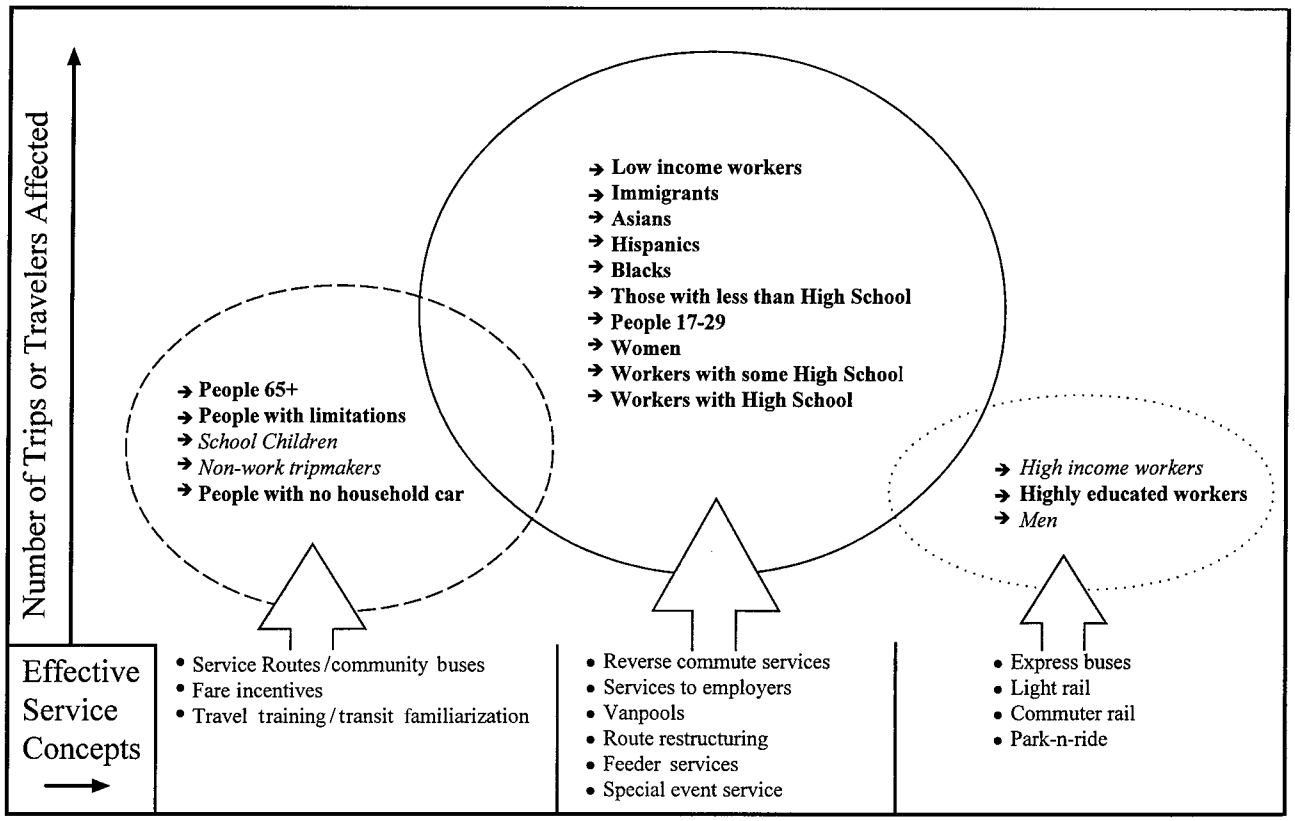
In Chapter 3, there was a brief analysis of the cost per new ride generated by each of the service options, without directly considering how many riders total, or total trips, would be affected by the concepts, which would maintain or expand current markets (as identified in Chapter 1), and which would create new markets? Figure 9 shows estimates of the likely ridership effects of each concept.

The analyses in Figure 9 depend on several assumptions which may not be realistic, which may change over time, or which may vary with the metropolitan area. These assumptions are as follows:

- They are all based on current ridership experiences as described in Chapter 3.
- They are all based on the qualitative cost-effectiveness assessments presented in Chapter 3.
- They all assume a comparable level of effort for each service concept—whether it is a vanpool program or a light rail system.

Given these assumptions, the greatest ridership effect would be seen from implementing services which target either specific work places or specific workers: vanpool incentives, reverse-commute services, and so forth. These kinds of services have been attractive to many market niches (remembering that many overlap substantially, such as women and low-income workers, or Hispanics and workers age 17 to 29); the markets affected constitute roughly 70 percent of all workers. Moreover, these concepts serve routine, frequent trips—those for work. Many workers would probably use these services for most of their weekly work trips.

Some of these concepts could create transit markets from groups not more reliant on transit, such as university students, school children, and high-income individuals. Route restructuring, for example, allows a wide range of students to use transit; special event services have attracted higher



Note: *Italized text* = Not currently a transit market.

Figure 9. Societal implications of implementing effective service concepts.

income, often male, riders who do not generally consider transit a viable option. Overall the number of individual riders and the number of rides each would take could be high for such service concepts.

The next largest ridership effect would probably result from services that target non-workers, or workers for non-work trips. Options such as community buses and travel training have attracted groups not currently constituting a transit market, such as children and older people. In addition, given their heavy reliance on public transit for commuting, immigrants to the United States (particularly women immigrants and those in the United States less than 10 years) may find such service concepts to be more attractive for their non-work trips.

Although there are 4 times as many non-work trips as there are work trips, riders attracted by options, such as community buses and travel training, probably would not use them routinely and frequently; therefore, such options would have less ridership effect than seen with commuter options. However, much of the population cannot drive or often seeks relief from driving—within a few years, one out of five Americans will be over 65 years of age. Successfully capturing only a small percent of the trips of this growing market might ensure ridership for decades to come.

The smallest effect would be seen among the group of largely commuter-oriented options which target groups not traditionally thought of as more likely to use transit (e.g., men, especially those who are highly educated or have high household incomes). Such workers constitute no more than 25 percent of the labor force; moreover, it is very unlikely that they will depend on the transit concepts considered every day even though they may commute (they may take the car several days a week or carpool). Although light and heavy rail options have had substantial effects on ridership in older, dense communities where they have existed for decades, the national effects are substantially smaller. If these options are being considered as new concepts, their effects overall would be slight.

The relevancy of the preceding assessments depends on the scale of services offered. One or two vanpools will not achieve the daily ridership of one light rail line, even if the vanpools are completely full and the light rail cars almost empty. The same level of effort (resources) must be committed to implementing each concept for these general comparisons to be of value. If rail systems achieve much higher ridership, some of these assessments would change as well.

EQUITY AND EFFICIENCY CONSIDERATIONS

To evaluate the magnitude of the societal effects of implementing various service concepts research team personnel

analyze both their equity and efficiency. Equity is a complicated concept; for many people, it implies a sense of equality or justice in spending or outcome. In general, the more equitable an outcome, the greater the benefit to society. Efficiency, also a complicated concept, is used here to mean some measure of how well a transit system meets its goals with a given amount of resources. The public, and transit systems themselves, have multiple goals for transit services. These goals include inducing automobile drivers to use transit, encouraging paratransit riders to use fixed-route services, and providing incentives for transit riders to take more trips or to make their trips in less congested times or along different routes. The more these desired outcomes are achieved, the more society benefits. Public policy decisions must be evaluated against many criteria; however, important criteria can conflict—something can be efficient without being equitable or equitable without being efficient.

Equity

Policymakers use many, often conflicting, definitions of equity. For those who see equity as a general measure of fairness, concepts that are expensive, serve fewer people, and are targeted at higher income individuals would be considered an inequitable way to spend public money. The same set of transit service concepts would also be judged inequitable by those who believe that equity means conditioning service on income or need (e.g., disability status), because this would generally require expending funds for those with the lowest income or greatest need. Similarly, if equity is seen as equality of input or output, the same set of transit service concepts would be inequitable. That is, providing all users with the same level of service or spending resources so that all users gain the same thing from service (e.g., number of trips) might be equitable regardless of the input. By these preceding definitions, service concepts such as park-and-ride lots and new rail systems might be seen as inequitable.

On the other hand, other definitions can lead to other assessments. It was not within the scope of this study to provide a comprehensive analysis of equity issues. Perhaps high-income users pay more of the taxes and fees which support public transit while low-income users pay little or none. If so, other definitions of equity might find that spending public money for rail systems was progressive, a standard some consider a working definition of equity. A progressive policy is one which redistributes resources; for these analysts, public transit spending would be equitable if low-income people got more than they paid for and high-income people less—relatively independent of the actual amount of benefit received.

The preceding evaluations are very sensitive to the reported ridership and market effects. The concepts considered might well have different effects in different communities. For example, even though research team personnel found no examples, park-and-ride services may be attractive to low-income rural residents commuting to metropolitan areas in some regions while express buses may serve low-income central city workers commuting to suburban jobs in other communities. In addition, over time, new rail systems may gain substantial ridership, both because ridership grows and because the system is expanded, permitting travel to more destinations.

Equity is not the only issue on which any public expenditure can be judged. Lawsuits are pending in several communities in which minority advocacy groups are suing transit systems over their expenditures for rail and other services targeted at "choice" riders. Complainants in one community, however, recently ended their suit in an out-of-court settlement in which the transit system agreed to lower fares and provide more bus services. Many involved parties were not sure that the equity argument would be successful in court. They believed that the community transit operator might successfully argue that rail systems had the potential to create new, denser land use patterns which would ultimately generate more transit riders, thus making more livable communities and reducing pollution.

However, when viewing equity alone, it appears that given limited resources and current ridership patterns, certain service concepts probably have much greater positive societal effect than others. These include service options, such as reverse-commute service, services targeted to employers, and route restructuring (which respond to the needs of many low- and moderate-income workers), or those, such as service routes, fare incentives, and, travel training (which respond to the needs of those who cannot drive or maintain a car).

Efficiency

Transit systems have many goals for their services, including gaining public recognition and political support, increasing total ridership, and redistributing ridership patterns (generally out of the period where they have too many riders to those where their vehicles and facilities have excess capacity). These goals may conflict. For example, services that are visible to the public and that the public supports may be favored over others, even if the favored services carry far fewer riders or cost far more.

The public also has expectations of a transit system which overlap only partially with those of any individual system. Voters and policymakers rarely see transit ridership as an end in itself; rather it is seen as a measure of the attainment of some other goal, such as reduced traffic congestion or environmental pollution, increased access to jobs by low-income workers, or increased mobility by the elderly and those with disabilities.

The efficiency of various service concepts in assisting transit systems to meet the major societal goals of reducing drive-alone commuting and supporting welfare reform are evaluated here.

Reducing Drive-Alone Commuting (Single-Occupant Vehicles [SOVs])

Reducing drive-alone commuting is generally seen as a way to decrease peak-period congestion, environmental pollution, and consumption of nonrenewable natural resources. But not all transit concepts gain their new riders from SOVs; some concepts, such as special event services or fare incentives, may encourage people to take new trips. Other concepts, such as vanpools or community buses, may simply take people away from other modes (e.g., carpools and paratransit services). The concepts most likely to gain riders from among car drivers are those geared to "choice" riders (e.g., light and heavy rail, express buses, and park-and-ride services).

However, even if such concepts gained a substantial percentage of their new riders from among car drivers, they would not better reduce SOVs if the total number of diverted riders was small relative to other concepts. Again, as suggested by Figure 9, some options reach so many more riders that the absolute number of diverted riders is probably higher, even if the percentage of any group affected is lower. Overall, the concepts which attract the largest total number of riders are the most likely to help communities reduce SOVs.

Even if the effective concepts gained all their new transit riders from among SOV drivers, they would still vary in the extent to which they achieved the goal of reducing driving—let alone congestion and pollution. The extent to which reducing SOV use actually reduces congestion, pollution, or energy consumption depends largely on the actual trip conditions and what happens to the car not driven to the final destination.

For example, policies can reduce SOV use during peak periods by moving those trips to other times; this would reduce congestion but would have negligible positive effects on pollution or resource consumption. Similarly, one driver in the family may switch to transit leaving the household car to be used more intensely by other members of the family; the effect on pollution, consumption, and congestion would vary with the use other family members made of the car. Providing park-and-ride lots in suburban locations might have negligible effects on pollution, even if it reduced peak-period congestion in the downtown or along major arteries.

Thus it is difficult—and well beyond the scope of this study—to fully determine the effects of any transit policy on the real goals most policymakers have in reducing SOV use. However, analysis suggests that those service concepts which are the most efficient at reducing SOV use are the ones targeted at low- and middle-income workers and at specific employment sites.

Welfare Reform

As described in Appendix C, one result of suburbanization and industrial restructuring has been that low-income people with poor skills are left in central cities while jobs matched to their skill levels have been moved to the suburbs. As more and more people no longer qualify for public assistance, transit agencies should assess how public transit could address the needs of this potential market.

For more than two decades, some policymakers concerned with the spatial mismatch of workers and jobs have seen transportation as the only or the most important factor explaining unemployment among inner-city residents. This assumption has been constantly challenged, and scholarly literature suggests that many factors affect unemployment. However, most reverse-commute services provided by transit operators have been effective in increasing transit ridership, whether or not they actually increased employment. These services provide an important equity function for society, even if they only provide better or faster services for already employed workers who are otherwise disadvantaged. In addition, it seems logical to assume that, if the cost of transportation to a suburban work site falls—in terms of money or time—more inner-city residents might see such jobs as worth the trip—even in the absence of welfare reform.

However, to be either more equitable about or more efficient at assisting welfare recipients to get jobs, transit operators would have to provide better reverse-commute services than they now do. As described in Appendix F, many reverse-commute services carry more passengers per hour with a higher recovery cost than with-flow services, but many transit agencies make more stringent demands on the services. For example, some transit systems will not provide new reverse-commute services unless they can recover 100 percent of operating costs from fares or employer subsidies.

In addition, many reverse-commute services are not provided directly from inner-city to suburb, although they could be. Workers take rail or bus service to suburban destinations and then transfer to feeder or suburban buses to finish their journeys; many have to transfer twice to make their work trip. Moreover, many systems accidentally have built up substantial reverse-commute ridership but refuse to change schedules or make concessions to the needs of inner-city riders. Without such service changes, transit agencies are not able to efficiently meet these reverse-commute needs.

SUMMARY

Given the assumptions on which the analyses in this chapter are based, the service concepts that could affect the most riders are those which provide more societal benefits, in terms of equity and efficiency. These service concepts are as follows:

- Reverse-commute services,
- Services to specific employers and universities,
- Vanpool incentives,
- Route restructuring, and
- Feeder services.

The least efficient and equitable services are those targeted at a few high-income or highly educated, largely male, workers. These concepts are as follows:

- Express buses,
- Light rail,
- Commuter rail, and
- Park-and-ride.

Consequently, the first group of services are those which confer the greatest societal benefits.

The assumptions on which these conclusions are based are extremely controversial. Most analysts would probably agree with the research team's assessments of current ridership patterns—which drive all the evaluations in this chapter—but many would disagree with the research team's assessments of the potential long-term effects of some concepts. Rail systems, in particular, are said to have the potential to facilitate major changes in land use, which could ultimately lead to greater ridership from among many different groups of users for both work and non-work trips. Whether such concepts can or will live up to this potential is the subject of debate in many metropolitan areas and within the transportation planning community and cannot be resolved here or within the resource constraints of this study.

CHAPTER 5

IMPLICATIONS FOR TRANSIT AGENCIES AND THE INDUSTRY

INTRODUCTION

Traditionally, transit operators have focused on providing services which target a certain type of trip—the work commute, for example—but not on targeting certain types of rider. They often concentrate on serving specific geographic areas, such as downtown or suburban malls, but not on serving specific market niches. They frequently gear services to specific land use patterns—such as low-density communities—without gearing service to specific user groups. Overall, transit systems have attempted to maintain and increase ridership by identifying trip purposes and destinations common to many, largely undifferentiated users and then providing a service that meets the minimum needs of as many of those users as possible.

The research team's analyses of societal trends shows that a different way of thinking about service planning and delivery will be required to maintain current markets, let alone increase market share or total ridership, and that an alternative approach may ultimately yield greater ridership gains. Rather than assuming that all travelers want, or can be made, to travel at the same time or along the same routes, the study findings suggest that transit systems would do better to find out where large market groups, such as Blacks, Hispanics, and immigrants, want to go and when, and fashion services accordingly.

Operators will have to re-think their traditional strategies, focusing first on rider needs and then on system constraints and resources. This approach often conflicts with the traditional way transit systems have operated. Marketing in most systems, for example, consists of efforts to convince the user (often in several languages and Braille) to ride the service already being provided—rather than on changing the service to meet the user's needs.

Providing a range of different services oriented to different markets may strain the resources of most existing transit providers. Current transit organizations often have a hierarchical structure well suited to building and expanding traditional transit services but unwieldy in delivering niche-oriented options. Some experts believe that older transit agencies may not be able to respond rapidly to the changes required by a market-driven approach to service provision.

In the following sections, the changes transit systems may have to make and the stresses they may have to face, both initially and over time, if they structure their services to focus first on the needs of specific market segments are outlined. Discussion of the implementation issues relevant to each service concept—which is beyond the scope of this study—can be found in separate TCRP and other agency reports. The following sections describe the problems or challenges common to the implementation of many of the 13 service concepts.

The first major section below describes six major areas within the organization of a system where stresses may occur. The second section below describes three sets of external relationships which must be developed or strengthened. This chapter ends by describing the research issues that the transit industry may need to explore.

EFFECTS WITHIN THE SYSTEM

Implementing effective service concepts geared to market needs creates two challenges for most transit operators: deriving operational patterns from traveler requirements and implementing effective service concepts to serve those patterns. To respond to the needs of specific transit markets, most transit systems will have to change not only the way they think about service delivery but the actual organization of the following six specific system functions:

- Planning and marketing;
- Operations, including routing and scheduling;
- Capital acquisition;
- Maintenance;
- Labor issues; and
- Financial issues.

Planning and Marketing

To develop market-appropriate services effectively, transit systems must first know more about who uses their services and when and why. It is not possible to maintain current ridership without knowing more about current riders. In addition, it is often easiest to increase per capita ridership among those currently more reliant on public transit.

The study found that most systems had very little demographic data about their own ridership patterns. Some systems felt that it was inappropriate to gather data by race or

ethnicity; others thought it too expensive to conduct the kinds of surveys which could gather more extensive rider information. But, given that different market groups have distinct travel patterns, transit operators should strive to know the kinds of services to which different markets currently respond.

Next, transit systems must know something about the characteristics of their service environment—both to better understand their current riders and to identify new markets or opportunities for expanding current markets. Much important metropolitan level data are probably already available from the metropolitan planning organization (MPO) and in city and county transportation and planning departments. Many transit systems do not take advantage of the relatively sophisticated data analysis and geographic information system (GIS) capabilities of other transportation or planning agencies in their region.

To understand their service environment, with or without the assistance of other planning organizations, transit systems should use Census and other available data to conduct analyses similar to those presented in Chapter 1 and to identify, where possible, the major O-D patterns of different market groups, within their own service area. The Census prepares metropolitan and urbanized area data in formats suitable for reasonably fine-grained analyses.

A transit system's goal should be to determine the characteristics of those who use transit and those who do not, which groups are more reliant on transit, and which specific services are used by which market groups. In addition, operators should attempt to identify geographic clusters of actual and potential market groups, as well as differences in their observed O-D patterns. Using such an approach, a transit operator can identify concentrations of individuals large enough to support various effective service concepts and a few concentrated destinations which attract them. For example, the routes of community buses designed to serve older people are routinely identified this way in most Canadian cities; Ann Arbor also used such a process before implementing their service routes. Many of the market groups likely to respond to the effective service concepts do not have the same O-D patterns as the average traveler or as the routes of traditional services.

Economic development projects and community groups often attempt to conduct informal O-D surveys of the travel patterns of inner-city workers, the elderly, single heads of households, or women—groups that have been induced to use transit more than average when provided with appropriate services. Several large communities which instituted major route restructuring based it, in part, on studies of the individual and specific travel patterns of various markets, rather than aggregating all trip patterns into the lowest common denominator.

In a related approach, systems have conducted GIS analyses of people with disabilities in order to identify or give priority to planned improvements in transit or pedestrian facilities. Although the motivating factor has generally been a need to reduce expensive paratransit costs, many systems have been surprised at the large ridership response of those with disabilities to such changes in traditional service.

Another important step is to conduct marketing and other in-depth studies among large local market groups and among those who could be market groups. The aggregate data analyses suggested above should be supplemented with qualitative and small-scale quantitative analyses of user preferences, needs, attributes, and patterns. This "fills out" the user profile in a way that can be used to design specific services for those markets. It also provides information useful in the design of advertising and informational campaigns targeted to specific users.

If new services are developed in response to the needs of specific market groups, such services must be monitored effectively. The transit operator must develop a set of standards against which to measure ridership performance and other objectives important to system management—from riders per revenue hour to percentage cost recovery. If ridership is less than expected, it is crucial to discover why.

Who is given these responsibilities will have a significant effect on their outcome. It is best if transit systems organize their planning and marketing departments to highlight these tasks, rather than distributing them among departments or adding them to other professional activities underway. These kind of activities need not dominate all other functions but they cannot be viewed as marginal to the organization or as a temporary exercise.

The location of user-centered planning and marketing activities within a transit system hierarchy says a great deal about how important a rider-oriented approach is to system management, governs how well market and rider issues are integrated into evaluations of service needs, and ultimately determines if the new approach really makes a difference in actual service and operational decisions, both initially and over time.

Operations

Although all of the effective service concepts identified in Chapter 3 have been implemented by one or more transit operators, they may be new—and challenging—to any given transit system. Or, more likely, an operator may have tried a concept on a very small scale, perhaps in response to an operational problem in one small area or in order to develop new service in another. In those cases, a significant increase in the amount of service is what poses the challenge. For example, most systems have a few reverse-commute routes, but should the system be pressed to develop many such routes, substantial routing and scheduling changes might be required.

Operators like to provide uniform service. By providing new or different service concepts, operators face a sometimes steep learning curve on the "new" services as well as the need

to learn how to balance different types of services, each with different parameters. Schedulers, for example, who are used to traditional services, may be uneasy at having to master three or four different types of scheduling algorithms, each matched to a different concept.

Some service concepts, such as route restructuring, inherently test the old way of scheduling and routing buses. Even if tried in a small area or just in certain sectors of the city, this kind of service concept calls for major changes in dozens of interrelated operational decisions, from where to garage and gas vehicles to how to organize driver shifts. If route restructuring is implemented in part (just route alignment or opening a suburban transit station, for example) or if it is implemented in just one sector of the entire service area, transit personnel may have to deal with different and changing services at the same time.

Of course, dramatic increases in the kind or variety of service create major and long-term learning and training issues. Several operators which developed light rail systems created entirely new service and scheduling departments to deal with the operational difficulties posed by a rail system.

Capital Acquisitions

The effective service options as a group pose special problems for those undertaking capital budgeting for a transit system. First, some of the vehicles used do not last as long as a traditional transit coach; both smaller buses and vans (used in vanpool programs) must be replaced much more frequently. In addition, as suggested above, they may have different maintenance and repair needs which require additional garages or special garage equipment.

Second, some of the service concepts are inherently capital intensive, requiring years to arrive at the construction phase and more years to construct and complete. A bus-only system will face entirely new programming and budgeting schedules, requirements, and development phases in implementing light or commuter rail projects. Building a rail system, and then buying rail cars, is very different from designing a route and then buying buses to run on that route.

Maintenance

Some of the effective service concepts identified in Chapter 3 require smaller or different vehicles than those operated by most transit systems. Community buses, for example, are thought to owe their popularity among riders in part to the greater attractiveness of a smaller vehicle.

Requiring an operator to mix several different kinds of vehicles in a fleet, especially if that fleet had been relatively uniform prior to the implementation of the new concept, poses maintenance and training difficulties as well as parts inventory problems. The number of different individual vehicle types may be too small to warrant keeping appropriately trained mechanics or sufficient parts either at all or throughout a large service area.

In addition, smaller buses, vans, and after-market bus and van conversions are expensive and difficult to maintain. This may require operators to keep a larger spare fleet than would otherwise be required. In addition, the manufacturers of many of these vehicles are small operations; they may no longer be in business when parts or new vehicles are needed, further complicating the task of maintaining and repairing vehicles and the vehicle fleet mix.

Labor Issues

Transit systems, in striving to be more responsive to their customers, sometimes forget to be more responsive to their employees. Employees can be valuable allies in a system's attempt to be customer-oriented and to develop services to meet user needs. First, system personnel can provide additional information on the needs and patterns of various markets. Second, their cooperation and support is needed to implement effective concepts. Third, they can help monitor services as they are implemented, suggesting changes and modifications.

Drivers and other personnel who deal daily with the public may have a wealth of information about who rides various routes, the services they value, and the policies and schedules which would better meet their needs. These same personnel may have practical advice about the organization and implementation of new concepts, and they are in the best position to see the real effect of the new services.

In addition, almost all service changes, particularly large-scale changes, can substantially disrupt the work lives of drivers, mechanics, supervisors, trainers, schedulers, marketers, and so forth. If employees are not given adequate notice, training, and time to absorb and learn what is coming and what is expected of them, the implementation of the new service concept and overall system performance may be adversely affected.

Some effective service concepts require new or modified work rules, even for bus-based services in a bus-only system. Operating reverse-commute or feeder services or express buses may create the need for split shifts or other personnel arrangements which do not conform to current work rules or labor agreements (or they may require overtime or premium wages). More major service changes, such as route restructuring, may totally change existing work patterns and schedules. These kinds of changes must be negotiated well ahead of service implementation.

Organized labor may be opposed to a given service concept. New services which come at the expense of old ones, as well as those requiring new skills or new duties of drivers, are likely to create concerns. Replacing traditional fixed-route services with community buses, for example, may cause concern because drivers may have new duties (e.g., helping older people onto the bus).

Those service concepts which reduce the number of system employees and/or give jobs to the private sector will be fought by current system personnel and their unions. In general, it will be easiest to implement services contracted to the private sector if they are additional rather than replacement services.

Financial Issues

In 1993, transit systems covered, on average, 37 percent of their operating costs from the farebox, a figure which has been growing steadily as federal and other external sources of funding have declined. This increasing reliance on fares leads transit systems to avoid many market-focused services because they either are, or are believed to be, more expensive per passenger, with lower cost recovery, than more traditional fixed-route services.

Some services are more expensive on average than traditional services. They may not be more expensive, however, than poorly used traditional routes. Thus, the ultimate test should be to compare new service to the current actual costs of serving a specific area, clientele, or destination with traditional services—not to the average cost of fixed-route buses. For example, several areas surveyed used community bus services to replace low-performing traditional routes. The systems considered these services to be effective because they cost less per passenger than had the services they were replacing (and generally increased ridership).

Having various service options in their arsenal can enable transit operators to save money. By focusing on who is actually being served by current services and who could be served by alternative options, transit operators can deliver the most cost-effective services to the markets and users being served. For example, seven passengers per vehicle hour is at the high end of paratransit but the low end of traditional transit service; at the same time, most traditional service costs between $80 and $120 per vehicle hour while most paratransit service costs less than $35 per vehicle hour. Although transit agencies would not replace a heavily loaded peak-period transit coach with paratransit service, few operators consider replacing an off-peak bus carrying three passengers per hour with a paratransit vehicle—even if the latter might double ridership and more than halve costs.

The biggest implementation problem facing most transit operators is that they are asked to try most service concepts in addition to existing services. In these cases, it makes no difference whether the new service costs more or less—net—than traditional services because the system must still have more money to operate. Without funds to test new ideas or demonstrate new concepts, many transit systems will be limited to implementing promising concepts only when the transit systems can immediately replace some existing, poorly performing service.

At the same time, changes to policy are creating different standards to use in evaluating the costs of various services. For example, the travel demand management programs required of regions not in conformity with Federal clean air standards, the growing interest in toll roads and congestion pricing of highway facilities, and the use of HOV and other preferential treatments for transit and carpools—all create a different policy environment in which to judge the costs of transit service provision. These may interact to create greater incentives for individual employers or groups of employers to work with local transit operators to develop responsive services, services whose cost-recovery factors may be well below those seen on more traditional services but which are subsidized by those employers.

Moreover, the effect of the Americans with Disabilities Act of 1990 (ADA) may change the way systems compare costs—providing service routes or travel training which encourage ADA-eligible travelers to use fixed-route service for any given trip may be substantially cheaper than providing them with paratransit service. The study survey of promising concepts found that more than a dozen small- to medium-sized communities decided to provide general public paratransit in all or part of their service area because it is cheaper—not than traditional fixed-routes service—but than the combined cost of providing both fixed-route and complementary paratransit services as required by the ADA.

EXTERNAL RELATIONSHIPS

Implementing many of the effective service concepts requires transit systems to deal in new ways with other agencies, individuals, and organizations or to intensify existing external relationships. Relationships with the following might be created, stressed, or highlighted with the implementation of new services:

- The private sector,
- Other operating agencies, and
- Other public agencies.

Private Sector

Several service concepts require transit operators to work with various groups within the private sector. There are several reasons why this is so. Some concepts will be more effective, cheaper, or both if provided under contract to the transit operator by a private entity (e.g., transportation entrepreneurs and private non-profit agencies). Some cities providing vanpool incentives contract with private companies to handle all details of vanpool provision from the vehicles to maintenance. Community buses and service routes as well as feeder services are logical candidates for private contract provision.

Second, some services have unique or very specific maintenance or operational needs which are best handled by the private sector. For example, rather than developing in-house

mechanics and parts inventories for specialized vehicles, many transit operators contract out maintenance and repair of just those vehicles to private vendors. Many systems which provide travel training also contract out this function to private consultants or to public or private agencies. In such cases, transit operators will have to develop a defensible, intelligent way of identifying those services best provided by the private sector and will need both the skill and the will to forge financial and service arrangements with private sector providers, employers, and organizations.

Third, several service concepts can only work well if they are coordinated with large employers or large destinations. To be effective, any service concept which provides direct service to a specific employer, such as reverse-commute and feeder services or vanpooling, must coordinate the location of stops, the hours and days of service, the route taken, and so forth with the employer(s) in question. Ridership will be enhanced if the private (or public) employer actively promotes the service to workers. In addition, in some cases, coordination with private entities can lead to cost-sharing.

For example, the survey found that when Sears relocated its Chicago headquarters, Sears worked with local transit operators to establish vanpools and nine subscription services for Sears' employees. SEPTA and New Jersey Transit have also been very effective in working with individual employers to develop reverse-commute services.

Other successful examples involve transit passes subsidized by large employers, either in conjunction with new, more site-focused services, or alone. The ridership increases occurring in university-campus-focused transit services are attributable to a combination of service and fare changes. The scheduling and route changes designed to more directly serve the universities in question made bus service a viable option for many more people; the fare incentives, largely paid for by the schools themselves (generally through student fees) made it both cheaper and more convenient.

Other Operating Agencies

People's travel patterns often cross jurisdictions and mandated service areas, especially because of the suburbanization of jobs and homes. Thus transit services targeted to their needs probably cross many jurisdictions. A central city system may have to operate within the jurisdiction of a suburban operator or develop joint-service agreements to provide or facilitate many of the effective service concepts. For example, transit operators in suburban Atlanta have worked with MARTA to facilitate feeder and reverse-commute services. To facilitate fare incentives in large metropolitan areas, a number of operators may have to develop joint pricing policies and fare systems.

Some service concepts, such as light and commuter rail, require the development of feeder services and coordinated scheduling. To do so, transit operators have to work with one another.

Public Agencies

To develop a system of services across a region and to achieve financing for services which cross multiple jurisdictions or serve multiple markets, transit operators may need to work with one or more MPOs, city councils, county commissioners courts, the state DOT, and other public and private bodies (from major public utilities to the local Chamber of Commerce).

Moreover, systems which attempt to provide effective services such as travel training for those with disabilities will have to work with agencies and providers totally outside of the transportation community. To do so will require learning a new vocabulary and responding to an entirely different set of rules and regulations.

The Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA) provides challenges to regional transportation planning agencies and offers individual transit systems a greater role in regional planning strategies. The mandated coordination between regional transportation planning and environmental planning efforts allows transit operators to become more involved in these issues, and, ultimately, facilitating the planning, development, and delivery of effective service concepts.

INDUSTRY RESEARCH NEEDS

Future action-oriented research on critical transit issues should consider how to do the following:

- Refine the definitions of the transit market groups which were identified in this study, by analyzing current transit ridership patterns by using more sophisticated statistical methods (e.g., analysis of variance, factor analyses, and regression, and so forth) to clarify overlapping characteristics such as race, education, and so forth;
- Project the actual magnitude of changes in ridership in individual transit markets, assuming different societal trends by using time series data and various appropriate statistical methods;
- Identify market patterns in a sample of individual metropolitan areas, using both aggregate and disaggregate data, following the format used in this study, and then using Census Transportation Planning Package (CTPP) data for a finer level of disaggregation, using both the descriptive method used here and more sophisticated statistical methods;
- Prepare comprehensive case studies of the implementation of effective (or promising) service concepts by conducting detailed before and after ridership evaluations and cost studies that focus on several systems implementing the same concepts or on individual systems implementing different concepts; and
- Conduct ongoing assessments of the outcome of implementing various market-driven service concepts.

SUMMARY

Transit operators must develop a more user-based approach to planning and delivering services. Most transit systems today provide a few services to many users with widely varying needs. At best, systems tinker with their services at the margins to respond to the differences among specific market groups—lengthening a schedule here, adding an extra vehicle trip there. The alternative user-driven approach requires transit systems to provide many expensive services to a few clients. The research team's analyses suggest that many effective services are no more expensive to provide than traditional services and can reach more riders.

Implementing many of the effective service options probably will pose multiple, serious challenges to many transit systems, but few of these challenges are as drastic or potentially devastating as the ones awaiting operators who fail to deal with the transformation in American travel patterns. Major societal upheavals in the United States have very negative implications for most transit systems. Unless they respond to the real, rapidly changing needs of the American traveler, most transit systems will see their ridership decline—and their public and political support with it.

Transit operators are seriously constrained in their struggle to compete with the options available to most travelers. Yet if individual operators, and the industry as a whole, do not respond to their markets, they will continue to lose market share.

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APPENDIX A

DESCRIPTION OF USER-REPORTED DATABASES

Much of the analytical work describing current transit markets was based on three national data sets, each of which contain sociodemographic and transportation information reported directly by respondents. These databases are as follows:

- 1991 American Housing Survey (AHS),
- 1990 U.S. Census, 5 percent Public Use Microsample (PUMS) Sample, and
- 1990 Nationwide Personal Transportation Survey (NPTS).

Each of these databases has strengths and weaknesses which may affect the analyses and conclusions. The main parameters of each survey are summarized in Table A-1 and described below.

THE AMERICAN HOUSING SURVEY, 1991

The American Housing Survey (AHS) provides extensive information on housing at the national and metropolitan statistical area (MSA) level; it also allows researchers to disaggregate market niches for the home-to-work trip. Conducted by the Bureau of the Census in odd-numbered years, roughly 50,000 housing units are surveyed in 44 selected metropolitan areas. There are four groups of metropolitan areas, each surveyed once every 4 years on a rotating basis; the same housing units are sampled each time (with adjustments for losses). The survey is undertaken in person by Census interviewers.

AHS transportation data are collected only as a supplement to housing data and only for the commute trip. Because the focus of the AHS is the housing unit rather than the household or its members, the uses to which the transportation data could and should be put are limited. Although the survey attempts to sample a wide variety of types of housing units, there is no effort to ensure a comprehensive sample of people by race, sex, income and so forth.

The Census Bureau provides weighting coefficients for the data, which allows data users to create a national sample—by housing type—but not by the characteristics of the people living in those houses. Because the 1991 data are not weighted by demographic variables, AHS data cannot be normalized to represent a national survey of transit users. However, as long as there are sufficient responses in specific demographic categories, the AHS can describe transit use by different kinds of people—so one can question, for example, what percentage of women or people making more than $60,000 generally take some form of public transit to go to work. One cannot ask what percentage of all transit riders are women or those making more than $60,000.

NATIONWIDE PERSONAL TRANSPORTATION SURVEY (NPTS)

The Nationwide Personal Transportation Survey (NPTS) is sponsored by the U.S. Department of Transportation; it has been undertaken in 1969, 1977, 1983, and 1990 (a 1995 study should be available shortly). The target population is all people 5 years of age and older; the survey is based on a random digit dialing process using a computer-assisted telephone interviewing system. In 1990, a total of 21,869 households were interviewed; each person over 14 was asked to recall and report detailed information about every trip taken on a sample day. Information on children ages 5 to 13 was supplied by an adult in the household.

Each household in the sample was assigned a specific 24-hr "travel day" and a 14-day "travel period" for which detailed data were collected. One adult was asked information common to all respondents in the household (e.g., number of household vehicles, access to transit, and so forth); all respondents were asked about the trips they took on the day and period in question. Thus the NPTS provides the only national data which permit examination of non-work trips or evaluation of tripmaking by household structure and various sociodemographic characteristics.

The data collected were organized into the following files:

- Household file,
- Person file,
- Vehicle file,
- Travel day file,
- Travel day file (segmented trips only), and
- Travel period file.

The study analyses relied largely on the travel day and person files.

The NPTS data are not completely comparable with other data sets because individuals without phones were not covered, there was non-response at the household and person levels, and there were question-specific non-response and other response errors which could not be fully compensated for. As a result, very-low-income Blacks and Hispanics may be underrepresented in the NPTS, although the lower rate of Hispanic responses may be the result of confusion created by asking two separate questions about race and ethnicity. (Apparently many Hispanics, when asked their race, replied "other" rather than White or Black or Asian.)[1]

TABLE A-1 Attributes of user-reported data sets

	1991 American Housing Survey (AHS)	1990 Census (5% PUMS)	1990 Nationwide Personal Transportation Survey (NPTS)
Original Sample Size	50,000 Households	10 million housing units; 12 million people	21,869 Households
MSA/PMSA Sample Size	50,300 People (Unweighted)	3,331,125 Households (Unweighted)	149, 546 Trips (Unweighted, in urbanized areas)
Survey Method	At-home administered questionnaire	At-home written questionnaire	Phone survey; recollection of one day's trips
Type of Trip	Work trip only	Work trip only	All trip purposes
Weighting	By housing unit only	By person and by housing unit	By final trip
Transit Use Measured by	Most frequent mode	Principal mode; longest distance	All trips counted
Bias	Misses those with fear of being interviewed	Misses those with fear of being interviewed	Misses people without phones, plus those with fear of being interviewed

The 1990 NPTS transit results differ considerably from those reported under Section 15 by transit operators; one explanation is that people may undercount transit trips—the least frequent trip mode—when asked to recall the trips which they made.[2] FHWA officials have found, however, that people tend to undercount the most frequent mode—the car—and thus undercount auto trips.

Some of the differences between the NPTS and Section 15 may be caused by how transit systems record unlinked trips so that a person transferring from one route or one type of transit is recorded as taking two (or more) trips in the Section 15 system but only one trip in the NPTS. Other differences may be caused by missing lower income travelers because they have no phone, are afraid to answer official surveys (because they are undocumented aliens or are fearful of authority figures), move frequently, or have no fixed residence.

The NPTS sample size does not allow analyses by specific service environments (because transit use for non-work trips is under 3 percent of all trips).

1990 U.S. CENSUS

The U.S. Census is undertaken every 10 years by the U.S. Department of Commerce as mandated by the U.S. Constitution. Theoretically, each person in the United States, regardless of status, is required to fill out a Census survey instrument; adults are asked to fill out forms for children in the household. The Census actively seeks questionnaires from those who do not return them or fill them out properly. Each housing unit in the country received one of two versions of the Census questionnaire: a short form that contained basic demographic and housing questions or a long form that contained those basic questions and additional questions. In rural areas, roughly one in two households received the long form; in urban areas, roughly one in eight households received the long form.

The long form of the Census contained several questions on which the analyses relied. Questions 24b through 24d asked of those people who indicated that they had worked anytime in a referenced week what their principal means of transportation to work had been. Persons who used different modes on different days were asked to list the mode they used most often; people who used different modes on the same day were asked to list the mode on which they traveled the furthest. This approach clearly undercounts transit ridership by those who use transit 1 or 2 days a week and by those who make a multimodal trip whose transit component is shorter than the nontransit component (e.g., by car to train).

This approach also explains some reports of transit use in areas where transit is not available. For example, rural workers might drive to a suburban bus or rail terminal for a trip to the center of a nearby metropolitan area. Their commutes would show as transit trips in the rural county in which they lived and not in the metropolitan county which provided

the service. Or people might have worked outside their own residential area during the referenced week and reported the mode they used while away.[3]

Census data are available at many levels of geographic detail; however, only the PUMS data permit researchers to conduct detailed evaluations using their own independent and dependent variables. Although this permits substantial analyses of transit use, PUMS data are limited to fairly large levels of geographic aggregation. The research team used the 5 percent PUMS data which contained more than 10 million housing units; the research team then used only metropolitan-area-level data. Although the research team would have preferred to use Urbanized Area (which is available in the data set), research team personnel could not incorporate population density into the data set below the metropolitan county level.

The metropolitan area data included all metropolitan statistical areas (MSAs) in the country: MSAs, primary MSAs (PMSAs), and consolidated MSAs (CMSAs). MSAs are areas with a nucleus of 50,000 or more people or an urbanized area and a total population of 100,000; they stand alone. PMSAs are similar except that they are part of a larger metropolitan region with several PMSAs; those larger areas are called CMSAs. Tucson and Phoenix, for example, are MSAs because they meet the minimum population and other criteria but stand alone. Tacoma and Seattle are each PMSAs because they meet the same criteria but are part of the Tacoma-Seattle CMSA.

Not being able to use Urbanized Area is a serious problem. Public transit services are usually provided only in the built up or urbanized area of a metropolitan region. This inability artificially lowers transit ridership by evaluating the ridership patterns of those who have no transit choices.

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APPENDIX B

TRANSIT OPERATORS WITH 100+ BUSES BY SERVICE ENVIRONMENTS

CITIES IN SERVICE ENVIRONMENT 21: POPULATION 50,000–200,000 AND DENSITY LEVEL <50 PSM

Billings, MT
Greeley, CO
Las Cruces, NM
Redding, CA
Yakima, WA
Yuma, AZ

CITIES IN SERVICE ENVIRONMENT 22: POPULATION 50,000–200,000 AND DENSITY LEVEL 50–1,000 PSM

Abilene, TX
Alexandria, LA
Altoona, PA
Amarillo, TX
Anderson, IN
Anderson, SC
Anniston, AL
Asheville, NC
Battle Creek, MI
Bellingham, WA
Benton Harbor, MI
Biloxi/Gulfport, MS
Bloomington, IN
Brazoria, TX
Bremerton, WA
Bryan/College Station, TX
Burlington, NC
Cedar Rapids, IA
Champaign-Urbana, IL
Chico, CA
Columbia, MO
Danbury, CT
Decatur, AL
Decatur, IL
Eau Claire, WI
Elkhart/Goshen, IN
Fall River, MA
Fayetteville/Springerville, AR
Florence, AL
Florence, SC
Fort Collins, CO
Green Bay, WI
Hagerstown, MD
Houma/Thibodaux, LA
Jackson, MI
Jacksonville, NC
Jamestown/Dunkirk, NY
Janesville/Beloit, WI
Joplin, MO
Kenosha, WI
Lima, OH
Manchester, NH
Mansfield, OH
Medford, OR
Merced, CA
Midland, TX
Monroe, LA
Muncie, IN
Nashua, NH
New Bedford, MA
Ocala, FL
Odessa, TX
Olympia, WA
Pascagoula, MS
Pueblo, CO
Racine, WI
Richland/Kennewick, WA
Rochester, MN
Santa Fe, NM
Sharon, PA
Sheboygan, WI
Springfield, IL
St. Cloud, MN
State College, PA
Terre Haute, IN
Tuscaloosa, AL
Tyler, TX
Waco, TX
Wausau, WI
Wichita Falls, TX
Williamsport, PA
Wilmington, NC
Yuba City, CA

CITIES IN SERVICE ENVIRONMENT 23: POPULATION 50,000–200,000 AND DENSITY LEVEL 1,000–2,000 PSM

Brockton, MA
New Britain, CT

CITIES IN SERVICE ENVIRONMENT 31: POPULATION 200,000–500,000 AND DENSITY LEVEL <50 PSM

Duluth, MN
Reno, NV

CITIES IN SERVICE ENVIRONMENT 32: POPULATION 200,000–500,000 AND DENSITY LEVEL 50–1,000 PSM

Albuquerque, NM
Anchorage, AK
Ann Arbor, MI
Appleton/Oshkosh, WI
Flint, MI
Fort Myers/Cape Coral, FL
Fort Pierce, FL
Fort Wayne, IN
Melbourne/Titus, TX
Mobile, AL
Modesto, CA
Montgomery, AL

Atlantic City, NJ
Augusta, GA
Aurora/Elgin, IL
Beaumont/Port Arthur, TX
Binghamton, NY
Boise City, ID
Boulder/Longmont, CO
Bradenton, FL
Brownsville/Harlingen, TX
Canton, OH
Chattanooga, TN
Colorado Springs, CO
Columbia, SC
Corpus Cristi, TX
Davenport/Rock Island, IA
Daytona Beach, FL
Des Moines, IA
Erie, PA
Eugene/Springfield, OR
Fayetteville, NC
Gainesville, FL
Galveston/Texas City, TX
Jackson, MS
Johnson City/Kingsport, TN
Johnstown, PA
Joliet, IL
Kalamazoo, MI
Killeen/Temple, TX
Lafayette, LA
Lakeland/Winter Park, FL
Lancaster, PA
Lansing, MI
Lawrence/Haverhill, MA
Lexington/Fayette, KY
Lincoln, NE
Loraine/Elyria, TX
Lubbock, TX
Macon/Warner, GA
Madison, WI
McAllen/Edinburg, TX
New London/Norwalk, CT
Niagara Falls, NY
Pensacola, FL
Peoria, IL
Provo/Orem, UT
Reading, PA
Rockford, IL
Saginaw/Bay City, MI
Salem, OR
Salinas/Seaside, CA
Santa Cruz, CA
Santa Rosa/Petaluma, CA
Sarasota, FL
Savannah-Robins, GA
Shreveport, LA
South Bend/Misawaka, IN
Spokane, WA
Springfield, MO
Stockton, CA
Utica/Rome, NY
Vallejo/Fairfield, CA
Visalia/Tulare, CA
Waterbury, CT
Wichita, KS
Worchester, MA
York, PA
Youngstown/Warren, OH

CITIES IN SERVICE ENVIRONMENT 33:
POPULATION 200,000–500,000 AND DENSITY LEVEL 1,000–200,000 PSM

Bridgeport/Lowell, MA
Milford, CT
Pawtucket, RI
Salem/Gloucester, MA
Stamford, CT
Trenton, NJ
Woonsocket, RI

CITIES IN SERVICE ENVIRONMENT 42:
POPULATION 500,000–1 MILLION AND DENSITY LEVEL 50–1,000 PSM

Akron, OH
Albany/Schenectady, NY
Allentown/Bethelhem, PA
Austin, TX
Bakersfield, CA
Baton Rouge, LA
Birmingham, AL
Buffalo, NY
Charleston, SC
Dayton/Springfield, OH
El Paso, TX
Fresno, CA
Gary/Hammond, IN
Grand Rapids, MI
Harrisburg/Lebanon, PA
Hartford, CT
Jacksonville, FL
Knoxville, TN
Las Vegas, NV
Little Rock/North Little Rock, AR
Louisville, KY
Memphis, TN
Monmouth/Ocean, NJ
Nashville, TN
Oklahoma City, OK
Omaha, NE
Oxnard/Ventura, CA
Raleigh/Durham, NC
Richmond/Petersburg, VA
Scranton/Wilkes Barre, PA
Springfield, MA
Syracuse, NY
Tacoma, WA
Toledo, OH
Tucson, AZ
Tulsa, OK
W. Palm Beach, FL
Wilmington, DE

CITIES IN SERVICE ENVIRONMENT 43:
POPULATION 500,000–1 MILLION AND DENSITY LEVEL 1,000–2,000 PSM

Honolulu, HI
Lake County, IL
New Haven/Meriden, CT
Providence, RI

CITIES IN SERVICE ENVIRONMENT 44:
POPULATION 500,000–1 MILLION AND DENSITY LEVEL >2,000 PSM

Jersey City, NJ

CITIES IN SERVICE ENVIRONMENT 52:
POPULATION >1 MILLION AND DENSITY LEVEL 50–1,000 PSM

Atlanta, GA
Baltimore, MD
Charlotte/Gastonia, NC
Cincinnati, OH
Columbus, OH
Dallas, TX
Detroit, MI
Denver, CO
Ft. Worth/Arlington, TX
Houston, TX
Indianapolis, IN
Kansas City, MO
Miami/Hialeah, FL
Milwaukee, WI
Minneapolis/St. Paul, MN
New Orleans, LA
Orlando, FL
Phoenix, AZ
Pittsburgh, PA
Portland, OR
Riverside/San Bernadino, CA
Rochester, NY
Sacramento, CA
Salt Lake City, UT
San Antonio, TX
San Diego, CA
Seattle, WA
St. Louis, MO
Tampa/St. Petersburg, FL
Washington, DC

CITIES IN SERVICE ENVIRONMENT 53:
POPULATION >1 MILLION AND DENSITY LEVEL 1,000–2,000 PSM

Boston, MA
Cleveland, OH
Ft. Lauderdale, FL
Newark, NJ
Oakland, CA
Philadelphia, PA
San Francisco, CA
San Jose, CA

CITIES IN SERVICE ENVIRONMENT 54:
POPULATION >1 MILLION AND DENSITY LEVEL >2,000 PSM

Anaheim/Santa Ana, CA
Bergen/Passaic, NJ
Chicago, IL
Los Angeles/Long Beach, CA
Nassau/Suffolk, NY
New York, NY

APPENDIX C

EVALUATION OF SOCIETAL TRENDS

INTRODUCTION

This section of the report describes the analyses undertaken in Task 2 and Task 3A. The objective of Task 2 was to, first, identify a range of projected societal trends—sociodemographic, economic, social, and policy—and then evaluate how these trends would affect the current transit markets identified in Task 1. Task 3A was designed to identify societal trends which might create new or future transit markets—in the absence of any remarkable changes in the transit service offered. Discussed in later work were those markets that might be created by implementing new or different service concepts.

The section below describes the major societal trends which could have, or may, affect travel behavior and ultimately transit use in the United States. Each subsection describes the factors most likely to change and how those factors will affect tripmaking behavior. The overall implications of changing tripmaking on transit markets are summarized and evaluated in the closing section of the chapter.

There are two serious problems with this approach. First, aggregate societal trends are unlikely to have the same effect on each metropolitan area; each trend will have to be evaluated by a community in terms of its own situation and environment. The Task 1 analyses showed that transit use is uneven; in all metropolitan areas combined, it accounted for less than 3 percent of all trips and 7 percent of work trips. However, ridership is substantially higher in certain areas. For example, in communities as disparate as San Francisco, Pittsburgh, Atlanta, and Boston more than 20 percent of all workers take transit to work. Conversely, Miami, which has roughly the same population as Atlanta, Detroit which is roughly the same size as Boston, and San Diego which has roughly the same population as Pittsburgh, each have substantially lower mode splits—12.9 percent, 10.7 percent, and 4.2 percent, respectively.

Second, these societal trends are strongly interrelated and breaking them apart for the purposes of analyses—while necessary—is often artificial. For example, it is difficult to talk about the growth of service-sector employment—a discussion included in the Economic Section—without talking about the growth of the population or immigration, both of which are discussed in the Demographic Section. It is even difficult to choose which factor to describe first. For purposes of analysis, each major set of societal trends is discussed separately, recognizing that such divisions may be arbitrary.

The discussions below focus on net changes in transit use and attractiveness created by the interplay of the complex societal trends described below. In some sense, the positive effects are being subtracted from the negative ones. Although the trends which reduce the attractiveness of transit or the ability of transit operators to provide effective services often swamp the trends which make transit more attractive, the positive trends can and should be the focus of transit operators who seek to maintain or improve ridership. Many such trends give individual operators opportunities to increase ridership—if not overall, at least in certain service areas or among certain riders—by targeting key markets with appropriate service options.

SOCIETAL BACKDROP

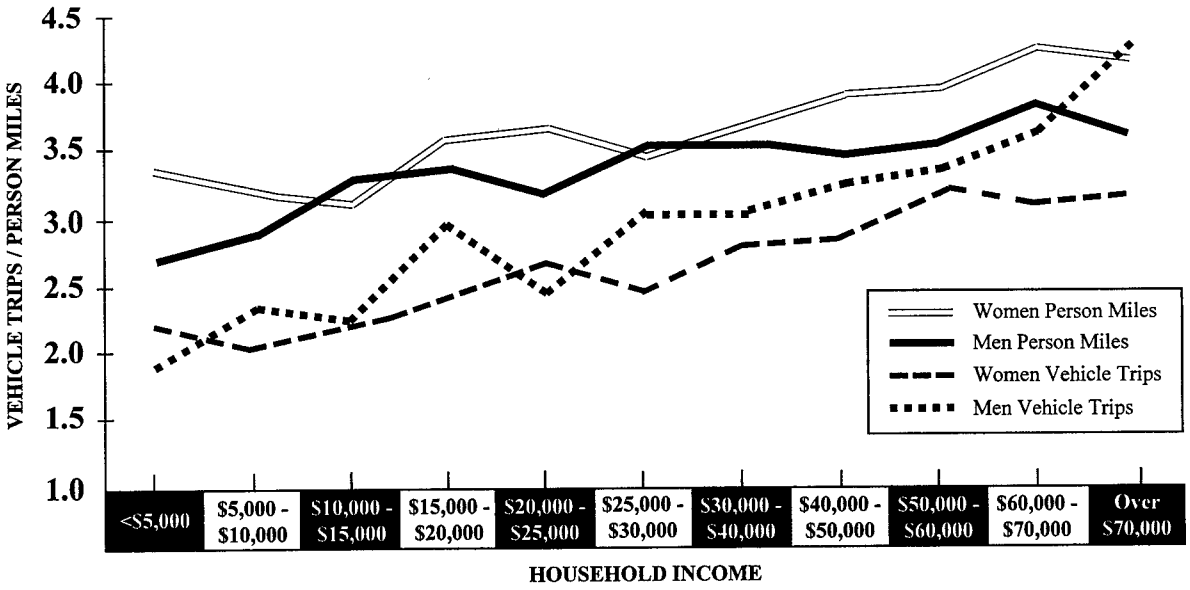
The societal trends examined take place in a world where transportation choices have already been changing substantially. This section opens with a description of the transportation environment in which the examined trends come together.

Income

Income is closely related to travel behavior; increasing income is directly linked to the desire for more travel, longer trips, and a greater dependence on the private car—here in the United States and throughout the world. Traditionally lower income has been associated with fewer and shorter trips, more often using transit or other alternatives.

All indexes of travel increase with income; for example, in 1990, households with annual incomes more than $40,000 made almost 3 times as many vehicle trips and traveled more than twice as many vehicle miles per year as those making less than $10,000. Figure C-1 provides 1990 NPTS data which show how both total person-trips and person miles increase with household income for men and women in urban areas. At very low incomes, people average around 20 person miles and 3.0 person-trips per day while at very high incomes people may travel more than 50 miles, making almost 4.5 person-trips per day. At the same time, women in urban areas usually take more trips than men with comparable household incomes, while men travel more miles than women with comparable incomes.

Figure C-2 shows that average work trip lengths in urban and rural areas increase for both men and women as household income increases. However, low-income people sometimes travel substantially farther to work than those making more. For example, urban men in households making between $5,000 and $10,000 travel 17 percent farther to get to work than men in households earning between $25,000

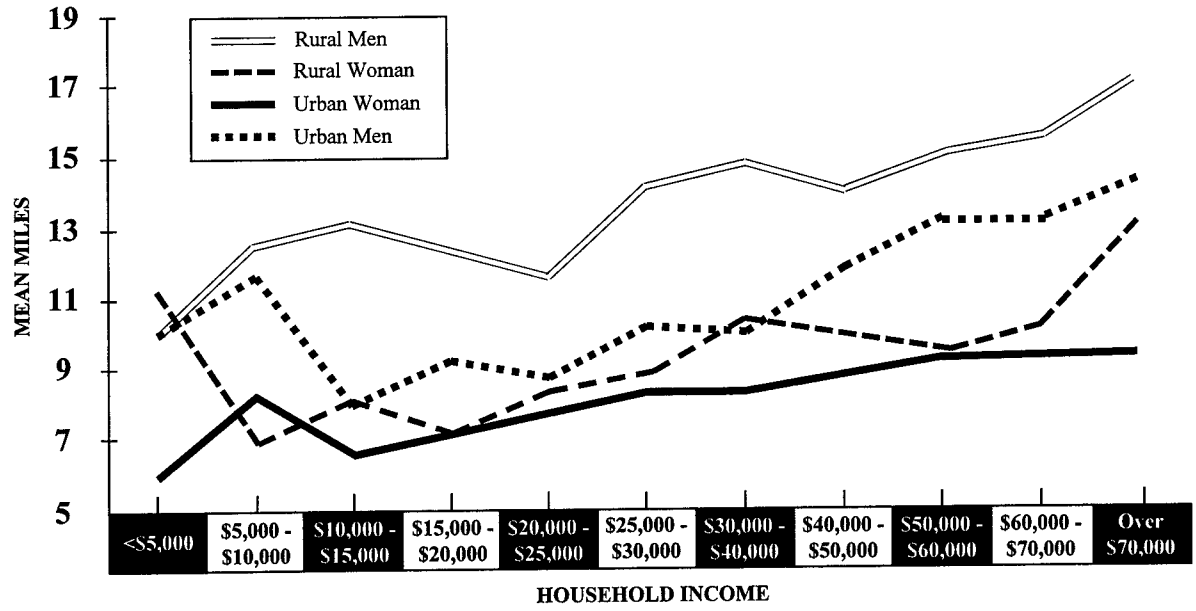


Source: S.Rosenbloom. "Travel by Women" in *1990 NPTS Report Series:* Demographic Special Reports. pg 2-27

Figure C-1. Urban daily person trips and miles; people age 16 to 64, by sex and household income categories.

and $30,000. These differences among low-income workers may be a result of the growth of the service economy to be discussed below.

For most of the last three decades, there have been significant increases in American household income—which in turn have strongly contributed to the growth of auto use and ownership and the corresponding decline in transit's market share. From 1967 to 1991, median household income increased 14 percent in the United States in constant (real) dollars. The Bureau of Labor Statistics has predicted that, between 1992 and 2005, per capita disposable income will increase at an average annual rate of 6.4 percent, reaching



Source: S.Rosenbloom. "Travel by Women" in *1990 NPTS Report Series:* Demographic Special Reports. pg 2-26

Figure C-2. Average trip length for work and work-related trips in urban and rural areas; people age 16 to 64, by sex and household income categories.

$39,000 in 2005—an increase of $21,000 from 1992. When controlled for inflation, this is a 1.5 percent annual growth rate in real disposable per capita income[1].

However, the first half of the last decade of this century has seen fairly weak income growth; overall real median income grew by only 0.4 percent since the mid-1970s while employer-provided nonwage benefits fell substantially. Moreover, the income gains of the past 30 years have not been distributed equally across the population; in many cases, population groups more dependent on transit have not fared as well as the overall population. In fact, some groups of Americans—particularly women heading households with children and elderly women living alone—have actually suffered real declines in income in the last decade. For example, the real earnings of young families and those with a high school education or less declined 30 percent from the early 1970s to the late 1980s[2].

Even among those with increasing real incomes, several subgroups have not seen their incomes increase as rapidly as the total population. For example, in 1987, Hispanics, who are both the fastest growing group in American society and disproportionately more dependent on transit, had a median family income of $20,300, two thirds of the median income of non-Hispanic families. In real dollars, the income gap between Hispanics and non-Hispanics grew between 1978 and 1987. Poverty rates for Hispanics increased in those 10 years as well; in 1987, 26 percent of all Hispanic families had incomes below the poverty level—compared with 10 percent of non-Hispanic families[3].

In 1987, the median annual income of Black families was $20,200—compared with $31,600 for White families. The ratio of Black to White income had actually fallen—to 56 percent since 1969, when Black family earnings were 61 percent of that of White families. The poverty rate for married Black couples was almost twice that of White couples, and higher in 1990 than it had been in 1978[4]. There may be two messages in these data; the first is that most income trends foreshadow declining transit use. The second trend, however, is that there may be growing transit market niches among those with low incomes. A large increase in any one market niche may have a major effect on overall transit ridership rates.

Growth in Drivers Licensing and Vehicle Ownership

U.S. transit markets exist, decline, or grow in a world where most people drive and either own a vehicle or have access to one. Between 1969 and 1990, the number of licensed drivers went up almost 60 percent and today licensing is almost universal among drivers of both sexes under 50. Licensing is growing rapidly among the elderly as younger drivers age; among those 30 to 49 almost 96 percent of the men and 90 percent of the women were licensed in 1990. This suggests that within 20 years there will be no more than a 5 percentage point difference in the licensing rates of any group of men and women under 70 and that most older drivers (i.e., those over 70) will be licensed.

Not only are the elderly almost as likely to be licensed; but so are people living in poor households. According to the 1990 NPTS, more than 70 percent of all people ages 16 to 64 with household incomes below $5,000 had licenses (71 percent of the men and 68 percent of the women). More than 90 percent of people ages 16 to 64 had licenses if they lived in households making only $25,000 per year.

Increased licensing is directly linked to the growth in travel in the last two decades. Table C-1 shows that people with licenses in both urban and rural areas travel substantially more than comparable people without licenses. In 1990, urban women 16-64 with a license made 76 percent more person-trips and traveled 191 percent more miles than comparable women without licenses, while urban men with licenses made 42 percent more trips and traveled 137 percent more miles than comparable men without. Most important, people with licenses traveled substantially more by car; men in urban areas made 2.8 vehicle trips per day—compared with 0.1 vehicle trips made by those without licenses.

Tripmaking and the distance covered in each trip grows substantially when licensing is combined with employment. In 1990, employed people with a license commuted roughly 10 miles to work while those without a license commuted 2.5 miles. Given that almost 96 percent of people working full time were licensed drivers, it is easy to see why increased licensing, combined with employment, has contributed to a major increase in the miles traveled by Americans. There are equally similar gaps in mileage for other trip purposes as well; for example, in 1990, a woman with a license traveled almost 3 times farther on average to conduct family and personal business than a woman without a license (11.3 versus 3.2 miles).

Vehicle ownership is also related to differences in travel patterns. Between 1969 and 1990 the average number of vehicles per household rose from 1.16 to 1.77 while households having two vehicles jumped 117 percent—an annual growth rate of almost 4 percent. At the same time, the number of households without a car fell by a third so that only 9.2 percent of U.S. households did not have a car. At the same time almost one in five households had three or more cars. As a result of these trends, in 1990, there were actually more cars than licensed drivers (or 1.01 cars per licensed driver) in America.

Of course, vehicle ownership is not distributed evenly through the population. Households headed by older adults are the most likely to be car-less; over 23 percent of all households without a car were headed by a person over 75 years of age, although they constitute only 6 percent of all U.S. households. More than 20 percent of one-adult households did not own a car in 1990 (compared with well over half in 1969). Also less likely to own a car were Black households, those headed by immigrants, and those without children[5].

TABLE C-1 Average daily travel parameters by sex and license holding, people age 16–64

	Urban		Rural	
	With License	Without License	With License	Without License
Person Trips				
Women	3.7	2.1	3.7	1.9
Men	3.4	2.4	3.3	2.1
Person Miles				
Women	30.9	10.6	37.3	16.0
Men	375	15.8	43.0	16.5
Vehicle Trips				
Women	2.8	0.1	2.7	0.1
Men	2.9	0.1	2.9	0.2
Vehicle Miles				
Women	18.5	.04	22.7	0.9
Men	27.7	1.1	3.6	1.4

Source: S.Rosenbloom. "Travel by Women" in *1990 NPTS Report Series: Demographic Special Reports.* pg 2-23

Thus, in the midst of increased travel associated with the use of the private vehicle there are people who cannot physically drive a car or afford to maintain one. But the number of people in this position is declining; in 1990, less than 10 percent of U.S. households did not have at least one car—compared with more than 20 percent in 1969[6]. Because car-less households were smaller, in 1990, only 6 percent of the entire population lived in a car-less house—compared with more than 21 percent in 1969. In short, most people have either a license or access to a car. Both the ever expanding number of drivers and the declining number of people without other options pose serious challenges to those trying to provide effective, appropriate transit service.

The sections below describe five categories of trends likely to affect the demand for transit in the future. The five categories are as follows:

- Economic,
- Demographic,
- Social,
- Land use, and
- Transport policy.

Each major set of trends is analyzed below. In general, most of the discussions below focus on the net effect of a series of complicated issues—that is, the result of subtracting those that create opportunities for transit operators from those trends which adversely affect transit. Although the negative trends tend to swamp the promising ones in the aggregate, many of the positive trends create micro-markets and the potential for transit operators to capture a significant number of riders—relative to their current ridership.

ECONOMIC FACTORS

Background

From 1970 to 1990, while the population of the United States grew 1.6 percent annually, employment grew 2.0 percent per year. As a result, in 1992, there were 20 million more people employed than there had been just 10 years earlier[7]. As the workforce grew, some industries gained a disproportionate part of the growth; the number of executive and managerial and technician jobs grew more than 50 percent from 1979 to 1990 while professional specialties grew

more than 40 percent. Jobs in the service sector grew almost 25 percent—while jobs in agriculture and those of operator and laborer actually fell more than 10 percent[8].

In the next decade, 25 million new jobs will be added to the U.S. economy; 94 percent of all those non-farm wage and salary jobs will be in service-producing industries. Within the whole set of service-producing industries, the Labor Department expects just one, the services division, the largest source of employment in the economy, to account for nearly one-half of all new jobs created in the next 15 years. More than one-quarter of the projected growth in non-farm salary employment (7.1 million jobs) will occur in just health and business services[9]. At the same time, most experts think that the major industries which lost jobs before 1990 would show modest growth; the number of agriculture jobs, for example, is expected to increase by roughly 3 percent by 2005[10].

As the job market has changed, so has the racial and ethnic composition of the entire labor force. In 1980 (the first year in which data were available), minorities of all kinds composed 18.1 percent of the U.S. civilian labor force; by 1992, that had grown to 22.2 percent[11]. Blacks increased their share of the labor force by 1 percent annually in those years—roughly the same rate seen during the previous decade—but Asians and others doubled their share of the labor force. In 1980, Hispanics accounted for 6 percent of the labor force compared with 8 percent in 1992. The growth in both Asian and Hispanic employment is tied to immigration; among Hispanics it is also tied to a higher birth rate, leading to a younger age distribution[12].

These changes encompass four significant trends likely to have important implications for transit markets and users:

- Industrial restructuring,
- Flexible labor force,
- Work at home and telecommuting, and
- Women's labor force participation.

Each of these trends is strongly related to one another; the second and third are largely a subset of the first, industrial restructuring; for clarity, however, each trend is discussed separately.

Industrial Restructuring

The change in employment called restructuring has been associated with

- The growth of service-sector employment and
- A growing gap in incomes among workers.

The Growth of a Service Economy

One of the most striking economic factors of the last three decades has been the significant change in the sectoral composition of the labor force—that is, changes in the industries and occupations in which most workers are employed. The most remarkable sectoral change is the shift from production and agriculture to service industries, that is, from work in factories or farms or mines to jobs, for example, in retail sales, public administration, private household work, banking, or communications. In the United States, the total number of service-sector jobs grew 73 percent from 1970 to 1990 while those in manufacturing grew only 2 percent and jobs in agriculture actually fell 6 percent. As a result, in 1990, there were almost 85 million jobs in the service sector in the United States—72 percent of total civilian employment[13].

The disproportionate growth of service-sector employment results from several factors. First, service work is labor-intensive, requiring more employees per unit of output. Second, global trade has created the demand for more services, particularly what have been called "knowledge-based services" as well as finance, insurance, and personal services. In fact, Finance, Insurance, Real Estate (FIRE) employment is growing at 4 percent per year in the United States.

Third, service-sector employment is less sensitive to downturns in the economy; between 1970 and 1990, there were several periods when the goods-producing sector lost jobs while the service sector continued to increase employment. Finally, the aging of the population and the substantial increase in salaried women has itself created a rapidly growing domestic demand for services in health care, day care, food, and leisure activities.

At the same time, the absolute number of jobs in the goods-producing sector will continue to grow in the next decade—even though that sector's proportion of all nonfarm jobs will drop to 13.2 percent (from 16.7 percent in 1992)[14]. In fact, a U.S. Bureau of Labor Statistics scenario projects that manufacturing employment will reverse its downward trend in the next decade, although the proportion of employment will continue to drop. In 1992, employment in manufacturing accounted for only 16.6 percent of the labor force—compared with 33.7 percent in 1950—but it had 2.5 million more jobs than in 1950[15]. Even within the goods-producing sector there will be winners and losers; manufacturing and mining are expected to show absolute job losses while construction industries will gain just over a quarter of a million new jobs by 2005.

Job change in the goods-producing sector, notably in manufacturing, has not been even across regions of the United States—this creates differential employment patterns in different parts of the country. In 1990, the Frost Belt (the Northeast and Midwest together) had 1.5 million fewer manufacturing jobs and, consequently, $37 billion less in worker earnings, than in 1980. At the same time, however, the Sunbelt (the South and West together) added 450,000 manufacturing jobs and gained $19 billion in worker earnings. So higher density parts of the United States are losing the kind of jobs that tend to be the most concentrated spatially and those with the most concentrated and consistent work schedules.

For example, retail trade will soon replace manufacturing as the second largest source of total U.S. employment; it is expected to generate more than 5 million jobs by 2005. This industry is dominated by part-time, low-skill, "demand little" jobs which offer little chance for advancement. Women have traditionally been the dominant participants in this division, accounting for 52 percent of the jobs in 1990 and holding 68 percent of the part-time jobs[16].

Income Disparities

Ironically, service-sector growth is such that there will be substantial growth in both jobs requiring a bachelor's degree or post-secondary training and jobs where a high school education is not required[17]. This trend may increase the gap between the wages of low- and high-skill workers; this will change the resources and options available to many workers, ultimately having a major effect on their transportation choices. Labor Secretary Robert Reich remarked in 1992,

> If you're not college educated, you're seeing your real income stagnate or even decline . . . If you are college educated, your income is growing. The gap between the two is widening.[18]

The United States has seen substantial widening of wage differentials as real wages fell 1.28 percent for low-skilled workers between 1980 and 1989. This drop is linked to the drop in demand for low-skilled workers even as the number of such workers has increased (largely because of immigration). As a result, today, the United States leads most of the world in the incidence of low-paying jobs[19].

Although many service jobs will be highly technical and well paid—jobs created in large measure by advances in technology—several experts expect that many lost production jobs will be replaced with lower paid service-sector jobs[20]. In 1990, roughly 66 percent of all service-sector jobs were white collar jobs; of those, however, only 43 percent of these white-collar jobs were highly paid "knowledge workers" (i.e., managers, executives, and professionals ranging from scientists to lawyers)[21]. The remaining white-collar workers were lower paid, as noted in a 1991 *Harvard Business Review* article,

> At the lower end of the pyramid in services is an enormous support staff—fully 57 percent of the White collar sectors workforce—that toils on the new assembly line of the information economy. Occupations in this category range from sales workers to secretaries to bank tellers and computer operators. In general their educational records are not particularly impressive, nor are their earning power and career opportunities.[22]

In other words, more than 70 percent of all service-sector employees (the one-third non-white-collar workers and 57 percent of white-collar workers [or 38 percent of all workers]) are not in well-paying jobs with meaningful advancement potential.

The rapid changes in the industrial structure of the economy have forced many of those already in the labor force to make drastic changes, often called "downward mobility[23]." Few former production workers have a meaningful chance for a smooth transition from declining industries into growing ones, largely because of their lack of education and skills; displaced from production jobs they will be unable to qualify for any of the better paying positions[24]. As a 1992 report by *Congressional Quarterly* noted,

> In many cases the jobs that have been lost will not come back . . . That means that today's unemployed will have to look elsewhere for jobs. For many that means changing not only employers but also industries, or moving to other parts of the country. Still others will have to undergo retraining in an effort to move into new occupations altogether.[25]

Young people coming out of high school will not have the jobs that were available to their counterparts two decades before. As a result, the U.S. Bureau of Labor Statistics has predicted that the trend toward income disparity will increase between 1992 and 2005.

Many large groups of American workers fall into the "bottom of the pyramid" because they are poorly educated or have low-skill levels; this means that they will be limited to low-paying jobs in the service sector, such as janitors, maids, restaurant workers, or sales clerks. The reasons for the lack of education or skill training are complex but discrimination is clearly part of the problem. For example, several minority groups achieve lower returns from additional educational training than do Whites; that is, they are likely to be paid less than other workers with comparable training or degrees[26 27].

These trends have significant implications for specific groups in society, particularly Hispanics and African Americans. In 1988, Hispanics made up only 7 percent of the total U.S. civilian labor force. However, since 1980, the number of Hispanic workers has increased 65 percent—4 times the rate of non-Hispanics—and a substantial expansion is expected as the Hispanic population continues to grow[28]. Hispanics have greater problems in the labor market than do non-Hispanics; in 1992, an average of 11.5 percent of Hispanic workers were unemployed—compared with 7.1 percent of non-Hispanics. Among the reasons are low average educational attainment, language problems, a large number of young workers, concentration in occupations with high unemployment rates, and discrimination[29].

As a result, Hispanic men and women are markedly overrepresented in low-paying occupations. For example, Hispanic men are more likely to be in lower paid factory, construction, and blue-collar work and Hispanic women more likely to be in lower paid service, operator, fabricator, and laborer positions than comparable non-Hispanics. As a result, the median weekly earnings for Hispanics employed full time were one-third lower than for non-Hispanics. However, even

when employed in the same occupational category, Hispanics made less; for example Hispanic men in managerial and professional jobs made 87 percent of the salary earned by non-Hispanic men[30].

Not all subgroups of Hispanics have the same employment opportunities, skill levels, or educational attainment—and these differences are reflected in income and participation rates. For example, although Puerto Ricans, when employed, are more likely to work in higher skilled occupations and have higher median earnings, an unusually large proportion of Puerto Ricans of working age are not in the labor force. Immigrants from Mexico and Central America have come to areas with expanding employment opportunities[31], while others, like Puerto Ricans, live in areas with declining labor markets, particularly for low-skilled workers[32].

Central Americans who have settled in Washington, DC, a community with a very rapid job growth rate, account for more than 20 percent of the janitors, cooks and construction workers—although they account for less than 6 percent of the District's population[33]. Houston, the entry point for many of those from Mexico and Central and South America, has also had a growing number of entry-level jobs which may explain the higher employment rate among those immigrants there.

A recent study on Hispanics commented,

> Their lack of educational preparedness is of increasing concern to business, industry, and government, particularly in light of the structural changes in the economy that require higher skill levels for entry-level employment . . . [there is] a growing mismatch between the skills new jobs require and the skills Hispanics acquire . . . Hispanics are over represented in the lower-skilled jobs that are expected to decline in coming years, and under represented in service-sector occupations that demand more education.[34]

African Americans have also been strongly affected by industrial restructuring. Between 1990 and 2000 African American employment is expected to grow between 10 to 20 percent so that these workers will compose as much as 20 percent of the entire U.S. labor force. Black women and men have long participated in the labor force in equal numbers; in the 1950s more than one-half of Black women were in the paid labor force compared with less than one-third of White women. However, while Black women's rates have continued to increase, reaching 58 percent in 1990, rates among men have been dropping; in 1990, only 70 percent of Black men over 16 were in the labor force compared with 77 percent of White men[35].

African Americans also have significant problems in the labor force. Blacks have higher rates of unemployment and remain unemployed longer than other workers; in addition underemployment—working fewer hours than desired—is thought to be more common among Blacks[36]. Even controlling for differences in age and education, Blacks have a harder time finding a job; for example, among men with 5 or more years of college, Blacks are more likely to be unemployed and to work fewer hours than Whites.

The occupational status of Black workers has improved over the last three decades—although not as fast as among White workers; as a result, a larger number are unskilled workers. In 1990, White men were twice as likely as Black men to hold jobs in administration, management, or a profession; conversely Black men were 1.5 times more likely to have semi-skilled jobs. For example, more than 33 percent of Black men but only 19 percent of White men were unskilled workers[37]. Moreover, most of the shifts of African Americans into more prestigious jobs occurred before 1980[38].

A recent study of African Americans noted,

> Many policy observers are concerned that the American economy will evolve into a two-tiered system of high- and low-wage jobs, and that Blacks who lack the educational training required for upward job mobility will become disproportionately clustered in the bottom tier . . . this two-tiered occupational structure will divide Blacks along educational and socioeconomic lines, creating a class of persistently poor Blacks.[39]

As a result of the growing wage gap accompanying deindustrialization, there will be a large and growing number of low-income workers, particularly among Blacks and Hispanics—both groups seen in Task 1 to depend disproportionately on transit in most service environments. As a result, transit use among these groups may actually increase in the coming decades.

The Flexible Labor Force

A key component of the service sector is the flexible labor force, which contains roughly one-fourth of all American workers. Flexible workforce commonly refers to people with variable work schedules with a given employer; those who work at different locations in a given period; those who consistently work for multiple employers in a given period; people who are not always employed full time, although they might wish to be; and the growing number of contract workers—people who do not work for a company but instead contract to sell their services for finite periods to different employers, often without receiving traditional benefits.

Associated with the growth of the flexible labor force are people working

- Schedules which vary over a short period;
- Multiple schedules, often going from one job to the next;
- At widely dispersed locations in short periods; and
- At multiple locations in short periods.

Although estimating how many people actually make up the flexible labor force, clearly these trends are strongly related to the growth of the service economy discussed above and have very important transportation implications which translate into very different demands on the nation's transit systems. Today, perhaps 34 million people compose the flexible

workforce—"contingency workers" who are available to respond to different employers' needs. Estimates are that by the turn of the century, almost half of the workforce will be contingency workers.

One component of the flexible labor force is people in temporary employment; temporary help employed by the business sector added one million jobs between 1980 and 1992[40]. Estimates are that between 1982 and 1993, temporary employment increased almost 250 percent while total employment grew only 20 percent. Temporary employment services place 1.4 million temporary employees each day—3 times as many as they did just a decade ago; 40 percent of the companies who are frequent users report that they use temporary employees as replacements for full-time workers[41]. In fact, Manpower, Inc., with more than 500,000 workers, has a larger workforce than either General Motors or IBM[42].

Another component of the flexible workforce are those working variable work schedules; in 1991, more than 15 percent of the U.S. workforce, or 12 million Americans, had flexible schedules which either allowed or required them to vary the hours they started or stopped work. This was a 25 percent increase in just 6 years[43]. Slightly more men (15.4 percent) than women (14.5 percent) worked variable schedules. Workers between 25 and 54 were substantially more likely to work flexible hours as were those working in the public sector (particularly the federal and state governments) and those in managerial and professional occupations.

A third component of the flexible workforce consists of those with multiple employers at the same time, including contract workers. In 1991, roughly 6 percent of the U.S. labor force, or 1.2 million workers, had more than one job, including contracts with more than one employer; men were more likely (6.4 percent) than women (5.9 percent) workers to have multiple jobs. The frequency was higher among both very high- and very low-paid workers. More than 9 percent of those engaged in public administration and more than 7 percent of those in professional or managerial occupations fell into this category as did almost 8 percent of service workers[44].

A 1994 study of workers with two jobs, or "moonlighters," found that the substantial growth in workers with multiple employers resulted largely from increasing rates of moonlighting among women. In 1970, roughly 2 percent of women versus 7 percent of men moonlighted; men's rates continued to drop and women's to increase slightly so that by 1994 they converged at 5.9 percent. The study attributed these patterns to several societal trends,

> In many cases, moonlighting reflects the individual's best choice when faced with the need for a flexible work schedule, but in many others it reflects growing economic hardship that threatens the financial stability of families. Moonlighting trends are linked to growing divergence between rich and poor, as well as a general sense that families are working more for less. Multiple-job holding by women has increased in recent years as a result of the increasing percentage of families headed by females, low relative wages, and stagnant male earnings.[45]

Married women, as well as younger and older workers, might prefer temporary employment because it gives them time to study or pursue personal interests[46]. However, several researchers have concluded that the growth of the contingent workforce is almost entirely the result of changes in the economy, including intensified competition among firms, the volatility of demand for products, and the declining bargaining power of workers[47].

The last key component of the flexible workforce consists of those who work less than 35 to 40 hours per week. The expansion of the service sector has been coupled with the rapid growth of part-time jobs; the rate of growth of part-time jobs has outpaced that of full-time jobs in almost all developed countries in the last two decades[48]. For example, between 1973 and 1990, the annual rate of growth of part-time jobs in the United States was 2.4 percent compared with 1.8 percent for full-time jobs. A recent Census study estimated that as many as 90 percent of the new jobs created each month are "involuntary" part-time jobs. With an expanding part-time workforce comes an expanding variety of work schedules and trip patterns.

The growth of the flexible labor force and service-sector employment itself have work schedule implications; together they involve various work schedules which change the traditional home-to-work commute. Recent Census data show that almost 40 percent of all women workers—who are disproportionately represented in service-sector employment—do not have a day shift job (defined as a work schedule where at least one-half of the hours fall between 8:00 AM and 4:00 PM). Twenty-three percent of all full-time working mothers and almost 60 percent of those working part time not only do not work the classic 9-to-5 day, they do not even work most of their hours during that traditional period[49]. Such schedules have tremendous effect on the transportation options open to workers, the safety problems which various modes may entail, and the home-to-work routes which they take.

The transportation implications of the growth of the flexible workforce are clear; commuting will be profoundly altered as the characteristics of the daily home-to-work trip change rapidly and frequently. Workers will see little point in choosing a home with some relationship to their job because their work location will change so frequently[50]; they may be less likely to walk or to try to find transit services and they will find it difficult to join carpools. It will be equally difficult for transit systems to provide convenient service to all the destinations to which workers could be sent—and for the variety of schedules they might be working.

Tourism

One of the fastest growing parts of the service sector is tourism travel, generated by both Americans and visitors from overseas; one of the largest components of the flexible labor force is people who work in this industrial sector. In 1990,

more than ten million Americans worked in all aspects of the U.S. tourist and travel industry—almost double the comparable 1975 total. Today, tourism is one of the largest employers in the United States and is among the top three industries in 39 out of the 50 states[51]. Both the clients and the workers in the tourism industry create a web of transportation patterns with significant implications for transit operators.

Much tourism activity and employment resemble all service-sector employment; that is, job sites may be widely dispersed, work schedules may be far different from the traditional 9-to-5 pattern, and average wages may be fairly low. However, tourism also displays significant seasonal peaks which have both direct and indirect transportation implications. In addition, several states are making tourism an economic development tool for rural areas so that very rural destinations are becoming major tourist and employment attractors.

The economic changes surrounding the development of tourism could alter the commute patterns of local residents and local workers and change inter-city and inter-regional travel patterns as travelers detour to take advantage of growing rural tourist attractions. Many of the resulting trip patterns—for both workers and tourists—will have distinct seasonal peaks, stressing transit systems greatly at certain times of the year while leaving them underused at other times. Overall, these very highly peaked seasonal demand patterns will be hard for transit operators to respond to, even in urban areas; because many may be in rural or low-density locations, transit service may not be able to respond at all.

Working at Home and in the Car

Two related employment trends within the flexible workforce have strong transportation implications: people who run businesses at home and people who telecommute to work. It is not always easy to differentiate these two trends and analysts have not always been clear about the distinction. Telecommuting usually involves working at different locations over the course of a work week or month; perhaps at home a few days, perhaps at the office other days. Running a business at home, however, generally means having only one work location, although the proprietor may travel to visit clients. Both trends create nontraditional commute patterns—patterns which may vary greatly from day to day.

The 1991 American Housing Survey found that roughly 2.6 percent of the population worked at home, roughly the same percent as in 1989 and lower than in 1985. However, these figures may blur some important distinctions between those who are self-employed, those working for pay at home, and those taking home work for which they are not additionally paid.

The Bureau of Labor Statistics found that of 20 million people who reported engaging in some work at home as part of their primary job in 1991, only 2 million were actually paid for working at home while 5.6 million were self-employed. The remaining 12 million nonfarm workers working at home were just "taking some work home from the office" and were not paid specifically for that work. Most of those who did work at home did not do so for much time; more than half of those paid for home employment, as well as those self-employed, worked at home for more than 8 hours per week[52].

People reporting any type of at-home work were slightly more prevalent in the West and least prevalent in the South. Poverty-level workers, elderly workers, those living in the suburbs, and those in rural areas were more likely to work at home. Many poverty-level workers were day care employees or ran their own day care homes. Overall, a greater percentage of women performed job-related work at home, although in numbers more men were home workers. That is, 3.5 percent of all women at work, or 1.8 million, were home workers—either wage and salary workers paid for hours worked at home or self-employed—while 3.2 percent of male workers, or 1.9 million, worked at home.

The propensity to be a home worker varied substantially with race—Whites were 3 times more likely to work at home than Blacks, and this went up with age. Salesworkers were the most likely to work at home; managers and professionals also had a high rate of home work (about 3 percent). Those who worked at least 35 hours a week at home were more likely to be in service occupations, generally hairdressers and child care workers.

Those people who work for pay at home are generally the focus of "telecommuting" discussions. A 1993 survey found that there were 7.6 million telecommuters—those working part of their paid week at home; approximately 75 percent were people working in information industries such as programming, accounting, data processing, marketing, planning, and engineering[53]. These are clearly professions that lend themselves more readily to work at home than do most production jobs. Because these industries may have substantial numbers of employees within the next 30 years, there is a strong possibility that telecommuting may have a substantial effect on transportation patterns in the future. The most likely effect on transit use of increasing telecommuting is negative.

At the same, there have been reports of the growing number of sales and other people who no longer have an office and use their cars as offices as they travel from one site to another. A recent *Wall Street Journal* article estimated that more than 6 million U.S. workers used their cars each day in lieu of offices—a number which some experts think will increase 25 percent by the end of this decade[54].

These trends will change commuting in many ways. Travel may be reduced as the number of days people must commute to work is reduced. It is, of course, possible that people will move much further from their workplace if they need not travel there daily, "using up" any mileage saved on the days they do not report to an external job site. It is also possible that those working at home or telecommuting will make longer non-work trips than they had previously. But

whether or not total trip making or mileage increases, all of these patterns will create work trip "commutes" that defy the traditional definition of the term. As such, they will be hard to serve with traditional transit services.

Women's Labor Force Participation

The aggregate growth rates of the labor force described above obscure the differences between the sexes; from 1970 to 1990, the participation rate of American women increased more than 14 percent—while dropping almost 4 percent for men[55]. The participation rate of women age 35 to 44 has grown most rapidly; in 1992, more than 75 percent of women in that age group were in the paid labor force[56]. As a result, almost 60 percent of all women have paid employment and they now account for close to half of the labor force; in 1992, women composed 46 percent of the total civilian workforce[57]—compared with 38 percent in 1970[58]. The Bureau of Labor Statistics estimates that by 2005, almost 64 percent of women but only 74 percent of men will be in the civilian labor force[59].

Participation rates are different among various subgroups of the population. Black women and men have long participated in the labor force in equal numbers; in the 1950s more than 50 percent of Black women were in the paid labor force compared with less than 33 percent of White women. However, while Black women's rates have continued to increase, reaching 58 percent in 1990, rates among men have been dropping; in 1990, only 70 percent of Black men over 16 were in the labor force compared with 77 percent of White men[60]. As a result, the participation rates of White women are roughly comparable to those of Black women.

Hispanic women are less likely to be in the labor force than non-Hispanics; in 1992, 52.8 percent of Hispanic women were employed compared with 57.8 percent of non-Hispanics. Women from Central and South America, however, were more likely to be employed than other Hispanic women and equally as likely as non-Hispanic women, while those from Puerto Rico were the least likely to be employed. The differences narrow when controlled for education; 81.2 percent of Hispanic women with a college degree were in the labor force in 1992—compared with 84.5 percent of non-Hispanic women[61]. Among women from Central and South America without a high school degree, participation was actually higher than among comparable non-Hispanic women[62].

A more striking fact than the increasing number of employed women is the growth in the number of married women who work outside the home. In 1990, almost 60 percent of all married women were employed, in contrast to 1960 when less than 33 percent of married women were in the paid labor force[63]. The aggregate figures also hide the dramatic increase in the labor force participation of women with children. In 1986, more than 61 percent of married women with children under 18 worked outside the home—compared with only 27 percent in 1960.

Aggregate data also obscure the even more substantial increase in the labor force involvement of married women with very young children. In 1960, only 18 percent of married women with children under 6 were in the paid labor force; the comparable number was 30 percent in 1970 and 33 percent in 1976. Today, almost 60 percent of married women with young children have salaried employment (while almost 75 percent of married women with children from 6 to 17 are in the paid workforce)[64].

Moreover, many of the employed women with children under six had very young children. In 1990, more than 50 percent of women 18 to 44 who had given birth in the previous year were employed—compared with 30 percent in 1976[65]. In fact, in 1990, almost 50 percent of all mothers of babies under 6 months were in the paid labor force—1 in 12 employed women had an infant[66]. A 1990 Department of Labor study found that more than 44 percent of all women return to work before their babies are 6 months of age—more than 66 percent of those on a full-time basis[67].

Although societal trends have increased both aggregate and per capita trip rates among women as they have among men, women seem disproportionately affected by the suburbanization of so many jobs, the growth of service-sector employment, and other demographic variables discussed below. The ways in which salaried women balance their domestic and employment responsibilities given these trends create substantially greater and different effects on the modes they chose, the hours they travel, the routes they take, and how they organize and combine their out-of-home activities. Table C-2 shows these patterns; at most income categories, working women always make more trips than comparable men, even though men travel more miles than women except at low incomes.

Other aspects of women's travel patterns are different than otherwise comparable men. How—and where—working women take care, or arrange for care, of their children while they work have important transportation implications. In 1988, less than 28 percent of all young children with salaried mothers were cared for in their own homes. As women increasingly find care options outside their own homes, they need to transport their children as part of their home-to-work commute. Between 1983 and 1990, women increased their per capita trip making by more than 10 percent—compared with just 6 percent for men—and increased their person miles traveled by 20 percent—compared with 17 percent for men.

Table C-3 shows how much the presence of children in a household affects the travel patterns of women, particularly single mothers. Women in two-adult households with children 6 to 15 make 21 percent more person-trips than comparable men; those with children under 6 make more than 9 percent more trips than comparable men. Single mothers always make more trips than either comparable women or

TABLE C-2 Indicators of travel by sex, selected income categories, and work status, 1990

	Daily Person Trips	Daily Person Miles
Household Income		
Under $5,000		
Female Workers	4.4	28.1
Male Workers	2.4	15.0
$25,000-$30,000		
Female Workers	3.8	28.1
Male Workers	3.6	31.9
Over $70,000		
Female Workers	4.1	36.6
Male Workers	3.7	55.9

Source: S.Rosenbloom. "Travel by Women" in *1990 NPTS Report Series: Demographic Special Reports.* pg 2-29

men, probably because they have no one to share the obligations which require travel.

Because they retain multiple responsibilities when they enter the paid labor force, women often "link" trips together, dropping children at day care on the way to work or going grocery shopping on the way home. Table C-4 displays 1990 NPTS data showing how often comparable men and women link trips together on the way home from work; in all circumstances, women workers are substantially more likely to link trips and to link multiple trips when they do.

But the mothers of small children, particularly single mothers, are much more likely to link trips than comparable male parents. For example, more than 40 percent of married mothers with children under 6, but only 30 percent of comparable fathers linked trips home from work; moreover, those employed mothers made slightly more multiple trip "chains." At the same time, single mothers were substantially more likely to link trips than either partnered parent; 47 percent of single mothers with children 6 to 15 linked trips home from work compared with roughly 36 percent of comparable married women and 27 percent of comparable married men.

Almost all studies have shown that women are substantially more likely to link trips home from work than comparable men; women are also more likely to form complex chains, that is, to link many trips together. For example, a 1992 survey in Southern California found that 29 percent of female workers made a stop on the way home compared with 19 percent of men[68] and that more women made stops on the way to work as well[69]. More than 25 percent of women workers making a stop to work were dropping off children, a detour almost always made 5 or more days per week[70]. A 1993 study of Seattle trip diary data found that women were less likely than men to go straight home from work; the authors concluded that, "this reflects the role of females in society and the variety of activities they pursue (e.g., shopping, personal business, and recreation) to satisfy personal and household activities."[71]

As a result of trip linking, women may take longer to make a shorter home-to-work trip[72] and may be more dependent on the car to do so[73]. An indirect indication of the second point—an Arizona study found that the more children a woman had and the younger those children, the more likely she was to drive to work while the number and age of children had no effect on men's mode choice[74]. Data from the 1990 NPTS show that women in households earning less than $30,000 took a higher percentage of all trips in a car than comparable men.

The differences were the greatest at the lowest income levels: women in households making less than $5,000 annually

TABLE C-3 Differences in average daily urban person trips by sex and selected lifecycles, 1990

	Two Adult Household	One Adult Household
Children 0-5		
Men	3.2	3.1
Women	3.5	3.6
Difference	9.40%	16.10%
Children 6-15		
Men	3.3	3.7
Women	4.0	4.1
Difference	21.20%	10.80%
Children 16-21		
Men	3.3	3.8
Women	3.4	3.6
Difference	3.00%	-5.20%
No Children		
Men	3.3	3.6
Women	3.4	3.7
Difference	3.00%	2.80%

Note: Percentages computed before rounding.
Source: S.Rosenbloom. "Travel by Women" in *1990 NPTS Report Series: Demographic Special Reports.* pg 2-32

made 74 percent of all trips in a car compared with 61 percent of the trips of comparable men. At all household income levels less than $25,000, women were more likely to go to work in a car than comparable men.

Even though employed women are a growing group and women are more likely to use transit than men, these trends are not likely to lead to increased transit ridership or increased market share in the long run. Women with children often have to make trips solely to meet the needs of their children[75]; therefore they may be less able to use alternative modes which are not conducive to chauffeuring small children on the way to or from work. Many workers report that their inability to stop driving alone is the result of their need for their car immediately before and after work, to their child care needs, and to their concern that they might be faced with a family emergency during the middle of the work day[76 77 78 79].

The Effect of Economic Factors on Current Transit and Future Markets

The major transportation and, ultimately, transit effects of the overall restructuring of national and international industry will arise from (1) different locational decisions made by service firms and industries, (2) growing income disparities, (3) the drop in the number of home-to-work trips, (4) wide variations in many individuals' work schedules and job location, and (5) the complicated travel patterns of working parents, particularly women and single parents.

The growth of the entire service sector has important implications—the growing suburbanization and even exurbanization of jobs are linked closely to the growth of the service sector. Service industries tend to be smaller and they do not need to be near one another in the way in which goods-producing firms traditionally did. Service firms tend to be widely dispersed within metropolitan and even exurban areas—rather than clustered and concentrated within the core of the city[80 81].

With the growth in communications technology and the substantial increase in various service-sector jobs has come dispersed employment locations which can create very non-traditional commute patterns[82 83]. For example, the commutes of suburban and rural residents are twice as likely to be destined for suburban and rural work places as they are for the central city[84]. In fact, in the 35 metropolitan areas which had

TABLE C-4 Urban trip-linking behavior by sex and lifecycle, 1990

	PERCENTAGE WHO LINK TRIPS FROM WORK TO HOME	NUMBER OF ADDITIONAL LINKS (%)			
		1	2	3	4+
ALL WORKERS					
MEN	28.7	49.5	28.8	11.6	10.1
WOMEN	38.8	46.1	28.8	13.4	11.7
SINGLE ADULT, CHILREN >6					
MEN	*	*	*	*	*
WOMEN	56.1	50.0	22.7	13.6	13.7
SINGLE ADULT, CHILDREN 6-15					
MEN	*	*	*	*	*
WOMEN	47.4	47.2	25.0	13.9	13.9
TWO ADULTS, CHILDREN >6					
MEN	29.8	53.5	27.5	11.5	7.7
WOMEN	40.6	51.5	25.7	14.5	8.4
TWO ADULTS, CHILDREN 6-15					
MEN	26.7	46.7	31.8	10.3	11.2
WOMEN	36.4	43.1	33.5	12.5	11.0

* = too few entries
Source: Complied from unpublished tape readable data from 1990 NPTS

more than one million people, fully 27 percent of all workers crossed a county line to get to work—a 50 percent increase since 1980[85]. All of these patterns are difficult to serve with transit, so as they increase, transit use will fall.

TCRP Project H-3, studying ways to attract automobile drivers to transit, undertook an analysis of the relationship between transit and sectoral employment patterns in more than 1,000 U.S. cities in 1990. The H-3 researchers found that employment in manufacturing and in two of the largest service sectors (i.e., wholesale and retail trade) was linked to lower use of transit. For example, an increase of 10 percent in the share of retail trade employment translated into an 11 percent reduction in transit use. The authors conclude that manufacturing employment now discourages transit ridership because so many facilities are in suburban and non-central areas and workers have variable shifts. They conclude that wholesale and retail trade jobs are associated with less transit ridership because these types of jobs are widely dispersed in neighborhood centers and malls[86].

The growth of low-income workers may, however, increase transit ridership because those with lower incomes have a greater tendency to use transit for both work and non-work trips. On the other hand, the location of even low-paying service-sector jobs may not be well-served by transit; it is difficult to provide traditional service in low-density communities. So the growing number of service workers with low or falling incomes may actually have to travel further to work simply because most available jobs are widely dispersed in suburban and even rural communities.

The changing industrial base of the country is also substantially altering the commute trip patterns of many workers; they are traveling at different hours, along different routes, and on different days in the week than comparable people two decades earlier. Commuter trips are now spread over a much longer day, wih a sizable minority of travelers having variable work schedules or working late at night or early in the morning[87]. As a result of these trends, many low-income workers may be forced to depend on a private vehicle as much as those with much higher income and may be forced to spend proportionately more—in time and money—for their home-to-work commute.

At the same time, the absolute number of jobs in the central city will continue to increase in many metropolitan areas, particularly in the West and South. Many of these jobs will be high-paid highly technical service-sector jobs—in banking, technology, and communications, for example. Even the absolute number of low-skilled jobs in the central core may increase. This means that, although most jobs will not be in

the central city, some will—and transit operators will continue to serve several market niches by providing service to the core. Moreover, in many suburban areas there are high employment concentrations—at malls, medical centers, and research parks. Workers at such facilities may be more able and willing to use available transit options.

Finally, many women—even those with low incomes—have responded to their complicated domestic and employment activities with substantial changes in the mode, time, routes, and destinations of their travel. Their choices are often very different than otherwise comparable men because they work in different places or on different schedules; have different concerns about safety; or must combine domestic, childcare, and employment travel to optimize their time. These choices and complicated patterns create significant barriers to their use of transit services.

So, although more women are entering the labor force and the absolute number of women using transit may go up in the near future, over time the percentage of working women using public transit may drop substantially—data from both the Census and the NPTS suggest that the drops in transit use are substantial even among low-income women and those with a greater dependence on it, such as Black women. Over time, given the other pressures at work, the market share among women workers might even fall low enough to cause a drop in absolute ridership.

DEMOGRAPHIC FACTORS

Background

The U.S. population has been growing 1.16 percent per year since 1980 reflecting (1) a rise in the frequency of childbearing, (2) a decrease in death rates, and, most significantly (3) sustained immigration[88]. Large and growing numbers of the U.S. population are from different cultural, racial, or ethnic backgrounds. In 1993, approximately 15 percent of the population was Black, 11 percent Hispanic (of any race), 4 percent Asian and Pacific Islander, and just under 1 percent were American Indian, Eskimos, or Aleuts[89].

By the turn of the century, the U.S. Census predicts the White population will account for 84 percent of the total population—down from 87 percent in 1993—while roughly 13 percent will be Black, 4 percent Asian or Pacific Islander, and 11 percent would be of Hispanic origin (of any race). However, by 2050 Hispanics may well compose 23 percent of the population while the White proportion will drop to just over half.

Population increase because of births is actually on the rise in the United States. There has been a substantial increase in the number of births in the United States—the number of annual births rose to 4.2 million in 1990, for the first time in a quarter of a century. Yet just a decade ago, demographers predicted a drop in fertility—they estimated that up to 25 percent of all women born during the "Baby Boom" would remain childless[90]. In fact, the rates of childlessness among this group are running only 17 percent—largely because so many of these women simply shifted childbearing to older ages. Most demographers feel that much of the increase in the entire population in the last decade was "catch-up" childbearing among "baby boomer" women in their 30s.

Immigration is also related to the growing number of U.S. births. Given that fertility rates differ by both race and ethnicity as well as country of origin for the foreign born, there are substantial questions about the effect of immigration on overall U.S. fertility rates[91]. Yet, as with native-born women, most variation in fertility rates is the result of demographic factors (education and workforce participation) rather than the mother's place of origin/birth, the duration of her stay in the United States, or whether she is naturalized[92]. This has led some Census analysts to conclude that the fertility patterns of immigrants "may eventually resemble those of native-born women."[93]

Immigration itself is one of the largest causes of this country's population growth and Latin America has been the major source of legal immigration to the United States since 1969—the primary country of birth being Mexico. More than 43 percent of the current foreign-born population came from Latin American countries; the bulk of the remainder of legal immigrants has shifted from those of European origin to those from Asia. Today, those born in Asia account for 25 percent of the foreign born compared with 21 percent from European countries. In fact, in the last half of the 1980s, the total number of Asian immigrants even outnumbered those from Latin America—1.32 million Asian immigrants arrived in the United States compared with 1.02 million Latin Americans[94].

These shifts are the direct result of major U.S. statutory and policy changes, including the 1965 Immigration and Nationality Act and the 1986 Immigration Reform and Control Act. As a result, the total number of American residents over 14 who were born in other countries grew 12.4 percent, or 2.7 million people, between 1983 and 1988. This increase was far from uniform; the number of those born in Latin America grew 56 percent while those from Asia grew 35 percent in the same period[95].

Most analysts believe that the growth of the Hispanic-origin population will be the major element in total population growth; a recent Census report predicted that the Hispanic population will contribute 32 percent of the nation's growth to the end of the century and almost 40 percent to the year 2010[96]. By 2000, there will be 31 million Hispanics; by 2015, the Hispanic population will be double what it was in 1990. In fact, much of the growth predicted for the West and South will come from the 8 million Hispanics that will be added to the population before the end of the century. Almost 81 percent of that number will reside in those two regions, more than half in just Texas and California[97]. This trend explains why Texas in 1994 replaced New York as the nation's second most populous state.

This section examines six major factors underlying the population growth of the United States; although overall population growth increases the aggregate amount of travel, these factors help to explain differences in the amount of travel by each individual:

- Growth of the aging population,
- Growth of single-parent households,
- Growth of single-adult households,
- Suburbanization,
- Migration, and
- Immigration.

The Aging Population

Background

American society is aging rapidly; in 1990 more than 25 percent of the entire population was over 60. Indeed, the elderly are the fastest growing component of the U.S. population; the number of those over 65 grew more than 20 percent between 1980 and 1990. Moreover, in 1990, there were 6.2 million Americans over 85, a number the Census expects to increase more than 400 percent by 2050. By the first decade of the next century, almost 50 percent of all elderly people will be over 75—and almost 5 percent of the entire U.S. population will be over 80. If birth rates continue to drop and migration does not increase, it is entirely possible that more than 50 percent of the U.S. population will be over 50 by the middle of the next century[98].

Among the elderly, women outnumber men by 3 to 2 and are overrepresented among the very old[99]. In 1991, almost 46 percent of women but only 37 percent of men over 65 were over 75 while more than one in four older women were over 80 (compared with less than one in five men). The U.S. Census Bureau predicts that, by 2010, more than 50 percent of all women while only 41 percent of all men will be over 75. Partially because of the age gap between men and women, older women are substantially more likely to be unmarried or to live alone. In 1990, almost 54 percent of women were widowed or divorced—only 19 percent of men over 65 were widowed or divorced, and more than 42 percent of women over 65 were living alone while 16 percent of men over 65 were living alone.

The diversity of America is increasingly being reflected in the makeup of the elderly; in 1990, roughly 7 percent of those over 65 were Black while 5 percent were of Hispanic origin (of any race). However, the Census Bureau predicts that by the middle of the next century, 12 percent of older Americans will be Black, almost 9 percent will be of races other than Black or White, and more than 15 percent will be of Hispanic origin. Hispanics were, on average, the youngest population group in 1990—with roughly half their population under 26.

The aging of the population has transportation implications because the elderly have different travel patterns than younger members of society, those elderly today have different travel patterns from those over 65 two decades ago, and a large and growing number of elderly need help in transporting themselves—or in obtaining services that substitute for travel.

The travel patterns of the elderly have been changing with the rest of society; many aspects of the travel patterns of those over 65 mirror those seen in the younger population. The elderly as a group are taking more and longer trips, traveling to new and different destinations. The elderly do take fewer trips than younger people, but largely because they have stopped going to work. For at least a decade after retirement, the only real difference between younger and older travelers is the absence of work-related travel.

Older people between 65 and 75 make as many or more trips than slightly younger workers for shopping, personal business, and recreation, traveling as many miles. This strongly suggests that those who retire retain all their "usual" travel patterns except the work trip for as long as they can; that they shop at the same stores and travel to the same doctors and visit the same friends, largely because they stay in the same neighborhood where they lived while members of the labor force and continue to drive to meet their needs.

Elderly People and Private Vehicles

Today, in contrast to 20 years ago, most older people are drivers; between 1983 and 1990 the increase in licensing among both older men and women was substantial—not, of course, because older people learned to drive but because younger drivers were aging. In 1992, almost 90 percent of men and 50 percent of women over 70 were licensed drivers; more importantly, almost 100 percent of men and 90 percent of those who will be over 70 in 2012 are currently licensed drivers.

The dependence of the elderly on the car creates major safety concerns; as the elderly population increases, so may accident rates. NPTS data show that those over 65—who constitute roughly 13 percent of the population and 12.4 percent of licensed drivers—account for only 8 percent of all accidents. But when the accident rate of the elderly is calculated by exposure, that is, by miles driven, the result is the well-known U-shaped curve; older and very young drivers have more accidents per mile driven than those in the middle. Moreover, the rate of accidents per exposure increases rapidly with increasing age after 60. In reality, older drivers have lower overall accident rates simply because they drive less[100].

Whether per capita increases in accident rates among the elderly will occur will depend on whether the newer generation of older drivers continue to drive less as they age—people used to driving may keep doing so—unlike previous generations. However, even if all older drivers either reduce their driving as they age, or newer generations of older people have better driving records per mile driven, a growing number of older people will still need travel options.

Some states are taking drivers licenses from older people, even empowering physicians and family members to "turn in" older unsafe drivers[101]. Most communities are offering these people few appropriate transit options to replace the mobility lost with their cars[102], although such travelers constitute a large, growing market of potential transit users. The absence of alternatives is one reason why some older drivers continue to drive, even if they recognize that their driving skills are deteriorating.

Residential Patterns

The travel patterns of older people, as well as the ability of transit operators to develop alternative services, are strongly influenced by residential patterns. Like most Americans, in 1990, more than 75 percent of all those over 65 lived in metropolitan areas, with almost two-thirds in the suburbs of those areas. Elderly people who live in the central cities of metropolitan areas are more likely to be members of ethnic or racial minorities and are also more likely to be women living alone and poor.

At the same time, more than 8 million elderly people lived in non-metropolitan, or rural, regions in 1990; because younger people have been moving out of nonmetropolitan counties, the actual concentration of rural elders has been increasing substantially. Nationally, the rural elderly constitute more than 15 percent of the population in the areas where they live[103] and the oldest old (over 85) are more concentrated in rural areas[104].

These patterns reflect the fact that, for more than three decades, the residential mobility of older Americans has been dropping. Most elderly people live in the homes in which they lived as younger members of the workforce[105]. Between 1986 and 1987, less than 2 percent of those over 65 moved far enough to change counties and fewer than 1 percent moved to another state[106]. In fact, among the elderly who do move, the largest percentage stay within the same region but merely change counties—for example, 60 percent of all moves by those over 65 living in the Northeast in 1986 to 1987 were to another county within the region.

From 1965 to 1970, roughly one in four older people changed their residence compared with only one in five from 1975 to 1980. Moreover most movement is among the very old, leading to speculation that those moves are related to health problems and may reflect relocation to nursing homes and care facilities[107]. For example, almost 30 percent of the elderly over 85 moved in the period from 1975 to 1980, compared with 20 percent of those in their 70s.

In short, most older people continue to live where they lived while working; increasingly, these are low-density or rural communities where it is difficult to access services or facilities without a car and where it is difficult to provide transit services.

Income Disparities Among the Elderly

Significant income differences among groups of the elderly may have transportation implications. Many elderly are wealthy; many are very poor. The poor elderly are largely single women, often minorities. At the upper end, the real median income of elderly households increased almost 20 percent between 1979 and 1989—or 4 times the increase for all households[108]. Moreover, although 3.4 million elderly people had incomes below the poverty line in 1989 (roughly one in ten) that rate was well below the overall poverty rate of the nation or of the elderly in the past[109].

However, at the low end, in 1990, two out of every five poor households in the United States were elderly households. A recent Census study concluded

> Growth in real income [in the 1980s] was weakest for elderly single householders, especially women, and those elderly households slightly above poverty. The situation was particularly acute for elderly Black women living alone—a group whose poverty rate changed very little in the decade. Elderly married couple households, on the other hand, appeared to have fared best during the decade.[110]

There will be little growth for those on fixed income, even if those income sources have automatic cost-of-living increases.

In general, elderly people living alone have the lowest median incomes; most of those over 75 who lived alone in 1990 had incomes below $10,000 and were 50 percent more likely to have poverty-level incomes than married couples. Elderly women living alone were more likely to have low incomes than comparable men. In 1990, for example, 58 percent of women over 75 living alone but only 42 percent of comparable men had incomes less than $10,000; 40 percent of women over 85 living alone were poor compared with 27 percent of comparable men. As a result, although women constituted 58 percent of those over 65, they accounted for almost 75 percent of the poor elderly. Living alone and in poverty is a potent constraint on travel.

Ethnic and Racial Diversity Among the Elderly

The ethnic and racial makeup of the older population may have travel implications as well. Several major studies have found that cultural and ethnic preferences have important transportation implications; there is a growing body of literature which shows that cultural or ethnic differences may well create variations in the kind and amount of ridegiving either requested by or provided to older relatives as well as older people's attitudes about transit safety and security[111 112 113 114]. Wachs found, for example, that elderly Mexican-American women were significantly less likely to have a drivers license but more likely to make trips in autos than other minority women or comparably situated Whites—generally traveling with relatives and family members.

Table C-5 shows that there are indeed differences in the travel of American elderly by ethnic and racial background; in 1990, Whites and Hispanics (of any race) were much more dependent on the private car and much less dependent on walking or public transit than Black or other older people. The table also shows that there are greater differences between men and women in some groupings; there is, for example, a substantial difference in dependence on the private car among Hispanics—older Hispanic men are much more likely to use a private vehicle and much less likely to walk than Hispanic women.

Older people from different ethnic and racial backgrounds also have different daily trip rates and cover different distances; for example, older White men make 32 percent more person-trips than older Black men and 22 percent more than older Hispanic men. Older White women travel more than 3 times the daily miles covered by older Black and Hispanic women.

Figure C-3 suggests that differences in income level do not explain these disparities in travel patterns; at all income levels, older White women made substantially more trips per day than did older women from other backgrounds and there were important differences between those women. Why people from different backgrounds have different travel patterns and whether these differences reflect the need for additional services or just variations in life style or personal and family norms about travel is not yet clear.

Overall, the growth in the elderly population might increase total transit ridership but transit's share of the total elderly market will certainly drop. Most elderly people will be well-off drivers, living in suburban areas where it is difficult to provide cost-effective transit services. Even that part of the elderly market more likely to use public transit—single women, those living in the inner city, and racial and ethnic minorities—may be dissuaded from using public transit by concern for their personal security, the fact that traditional services do not well serve the destinations to which they wish to travel, or the willingness of their relatives to provide mobility. In the absence of new carefully tailored service options, ultimately transit ridership will drop among the elderly as a group.

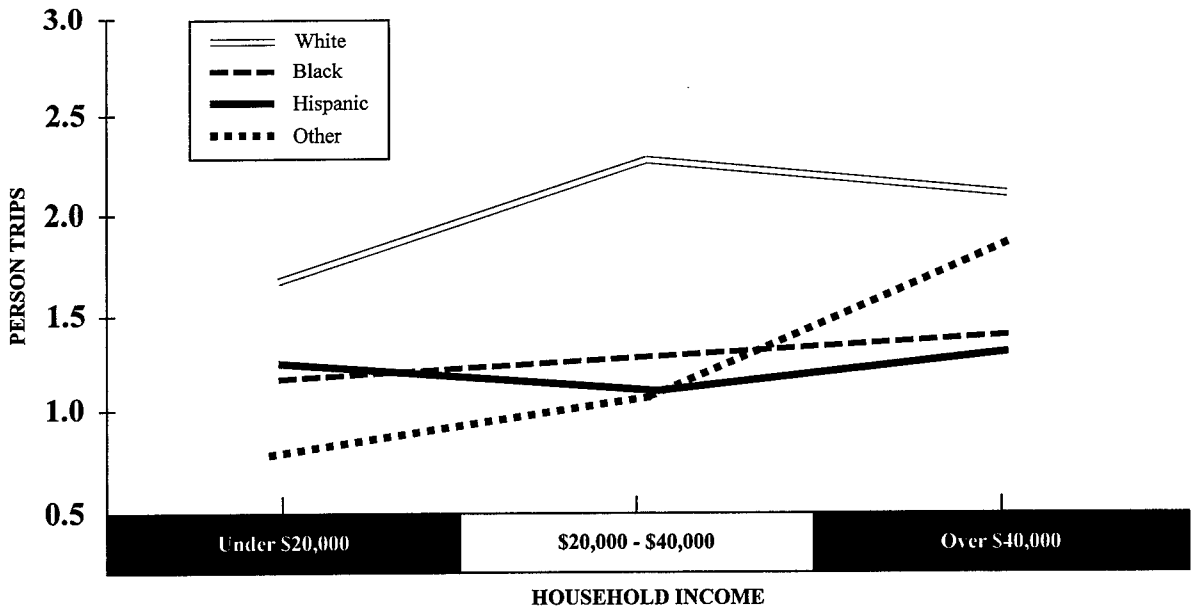
Single-Adult and Single-Parent Households

Between 1969 and 1990, the number of American households grew almost 50 percent while the population grew only 21 percent. The largest share of the growth was created by single-person and single-parent households. The number of one-person households grew almost 41 percent while the

TABLE C-5 Urban travel mode for all trips, those over 65, by sex, race, and ethnicity

	Private Vehicle	Transit	Walk	Taxi	All Others
Hispanic (any race)					
Men	85.6%	3.6%	9.0%	-	1.8%
Women	3.6	4.6	15.2	1.5	4.5
White					
Men	91.6	1.4	6.2	0.2	0.6
Women	88.4	1.7	8.7	0.5	0.7
Black					
Men	71.0	13.7	13.7	-	1.6
Women	69.7	13.5	15.4	1.4	0.0
Other					
Men	70.7	12.1	14.1	-	3.1
Women	70.0	16.3	12.5	1.2	0.0

Source: S. Rosenbloom. "Travel by the Elderly" in *1990 NPTS Report Series: Demographic Special Reports.* pg 3-34.



Source: S.Rosenbloom. "Travel by Elderly" in *1990 NPTS Report Series:* Demographic Special Reports. pg 3-41

Figure C-3. Average daily person trips; total by women over 65 by race and ethnicity, 1990.

number of single-parent households grew 36 percent; as a result, the average household size fell roughly 20 percent between 1969 and 1990. During the same period, the growth rate for more "traditional" families was only 8 percent. The substantial growth in these new, smaller, family units is linked to divorce, children born to never married parents, and young people leaving their parents' homes to be on their own.

Over the last two decades, the number of families headed by women alone has increased from 11 percent to 20 percent. As a result, the percentage of children living with both parents dropped more than 15 percentage points between 1960 and 1990 while the percentage of children living with just one parent tripled. In 1990, 3 percent of all children lived with only their fathers while 22 percent of all children lived with only their mothers.

The Census Bureau recently reported

> In 1990, one-parent family groups accounted for 22.6 percent of all White, 60.6 percent of all Black, and 33.2 percent of all Hispanic family groups. For Black children, the one-parent family group is now the most common living arrangement. For White and Hispanic children, the one-parent family group is now a common arrangement, but not the most common one.[115]

Families headed by a woman alone have considerably higher poverty rates than any other type of household—in 1990, more than 33 percent were living below the poverty level[116]. In fact, the income of families maintained by a woman with no spouse dropped 5 percent in real dollars between 1967 and 1991[117]. As a result, families headed by a woman alone constituted a substantial portion of all poor families: more than 50 percent in 1978 and more than 53 percent in 1990[118]. To raise themselves just over the poverty line, the average family headed by a woman alone would require an additional $5,661 per year in 1990 dollars[119].

The growing number of smaller households has important transportation effects; one person in a small household is likely to make more trips than the same person in a larger household. For example, in 1990, the total daily trip rate of a two-person household was 5.87 trips; this was an average of 2.87 trips per person, compared with 2.94 daily trips for an individual living alone[120]—an 11 percent difference in daily per capita trip rates.

The difference is even larger in households with only one car. In 1990, a person living alone who had one car made 3.24 person-trips per day, which was 19.5 percent higher than the average per capita trip rate in a two-adult household with only one car[121]. Also one-person or one-adult households are more likely to have one car per person than are two-adult households. For example, in 1990, almost 80 percent of single-adult households had at least one car, and thus one car per adult, while only 76 percent of two-person households had one (or more) cars per person[122].

That many single-parent households are poor also has transportation implications. Many low-income women who head households may live in the central city but commute out to the suburbs for employment because that is where jobs matched to their skill levels exist. As a result, they may be traveling longer than workers making more money. This may explain why, in 1990, urban women with household incomes

less than $5,000 traveled 33 percent more person miles each day than both men with incomes below $5,000 and than women in households making $20,000 to $25,000. Those in households making between $5,000 to $10,000 traveled more than 8.5 miles to work; no other group of women traveled that far until they had incomes in excess of $25,000[123].

Poor central city residents may also be disproportionately dependent on the private car, given their low wages. Probably because many trips from the central city to the suburbs are so difficult to make using public transit, in 1990, urban women with household incomes between $5,000 to $15,000 were more likely to use a car for their work trip than comparable men. Women in households with incomes between $10,000 to $15,000 were more likely to travel to work in a car than men in households making $10,000 more[124].

Conversely, low-income urban women were less likely to use public transit for their work trip than comparable men; more than 8 percent of men but only 5 percent of women in households with incomes between $10,000 to $15,000 used mass transit for their home-to-work commute[125]. In fact, transit use on the work trip dropped twice as fast among women from 1969 to 1990 as it had among men[126]. Thus poor urban women heading households may expend substantially more of their income on transportation than comparable men or than either sex with more resources.

Overall, the growth in both single-adult and single-person households does not bode well for public transit. People living in smaller households travel more and do more of that travel in a car. Moreover, single parents must juggle employment and domestic responsibilities; this tends to reduce their ability or willingness to use public transit, even at low incomes. As the preceding section describing women's labor force participation detailed, salaried single mothers often make the most number of trips per day and are the most likely to link multiple trips together; patterns that defy easy transit use.

Increased Suburbanization

Overview

Coupled with most of the demographic and economic trends previously addressed—and the ones below—are the suburbanization of both employment and the population, issues addressed at greater length in a major subsection below. Within metropolitan areas, most population growth in the last three decades has been in what can be classified as suburbs[127]. Unfortunately, there is little good information on what most people would consider a suburb—that is, low-density development far from the traditional core of the city. Most analysts base their definition on U.S. Census data, which do not actually define suburbs.

With no clear definition of suburb in the Census, most authorities define suburban as that part of the urbanized area of a metropolitan area which is not central city. This creates ambiguities. The Census defines central cities as jurisdictions with at least 50,000 people serving as the economic and social center of a metropolitan area; however, a metropolitan area can have several central cities and the central city may not be in the center of the metropolitan area. Using the actual legal boundaries to define central city both undercounts and overcounts low-density residential and employment development, even in the same metropolitan area.

Low-density development is overcounted by considering older incorporated suburbs—that is, not within the jurisdiction of the central city—as suburban even though they have high density and are very near the traditional downtown of the central city. On the other hand, the central cities in many Southern and Western metropolitan areas have annexed substantial low-density and even undeveloped land; regardless of the distance from the traditional core or the density of development, these areas are not considered suburban. So both Compton (California) and Yonkers (New York) are considered suburban—although they are fairly old and dense communities, while people living and working 20 miles from downtown Houston (Texas) or Jacksonville (Florida) in very low-density settings are considered central city residents.

In short, the suburban data can only give a general idea of the patterns occurring across the country; they are not very useful for looking at individual metropolitan areas unless there is additional local information. The undercounting of suburban residents occurring in some metropolitan areas may be matched by overcounting of suburban residents in others—but this has not been verified.

Population Growth

The dimensions of this suburban population growth are staggering: while U.S. population rose 56.1 percent in the 40 years since World War II, central cities only grew 49.9 percent. In contrast, the suburban population grew almost 200 percent in the same years. In short, most of the increase in metropolitan population was actually in the suburbs. As a result, even older cities are becoming less dense as low-density suburbs grow up at their peripheries[128].

Since 1950, about 33 percent of the total U.S. population has lived in the central city, but the suburban portions of metropolitan areas increased from 23 percent of total U.S. population in 1950 to 46 percent in 1988[129]. Although central cities grew faster after 1980 than they had after 1970, their growth rate was less than half that of the suburbs[130]. In fact, the suburbs absorbed almost 76 percent of metropolitan growth in the decade of the 1980s[131]. Thus, overall, central cities have grown but at not nearly the rate of their suburbs.

Analysts have seen a slight turnaround from 1980 to 1990. The average annual growth rate of all central cities in the United States was up—to 0.64 percent from 0.09 percent during 1970 to 1980 while the suburban growth rate had declined—to 1.42 percent from 1.73 percent in the previous

decades. There were important regional differences. The drop in absolute population in Northern central cities continued between 1980 and 1990—but at a slower rate of decline.

On the other hand, the growth rate of Southern central cities dropped while that of Western central cities experienced the largest increase in the annual rate of growth—from 1.53 percent for the 1970-80 decade to 1.95 percent. Although many are hailing these patterns as a mini-urban revival, the growth rate of suburbs substantially exceeds that of the central cities—even if that growth rate has dropped a bit. In both the South and the West, annual suburban growth rates exceed 2.2 percent a year[132].

As suggested by the figures above, not all central cities grew; 43 percent of the central cities of recognized MSAs (or 222) lost population in the last half of the 1980s. The incidence of loss was highest in the Northeast where more than 70 percent of the central cities lost population (and where over half of the central cities had been declining in population since 1950)[133]. Conversely, fewer than one in five central cities in the West experienced absolute losses.

These trends do not always have the same effect on land density, the relevant factor for transit use. As described in a subsequent section, suburbs may become denser if more housing units are built per acre, or if proportionately more multi-family housing is built, or if more people live in each housing unit. They will continue to decrease in density to the extent these conditions are not met. For example, TCRP Project B-6 reported that most multifamily housing built in the 1980s was built in inner suburban corridors in low-density configurations—12 to 18 units per acre. The study reports that

> . . . forecasters predict that much of apartment and condominium construction in the mid-to-late 1990's will be in the new outer suburbs, near emerging edge cities (e.g., Gainesville in northern Virginia and Peachtree City outside of Atlanta) or immediately adjacent to inner-ring edge cities (e.g., Ballston, Virginia, and Atlanta's Buckhead district).[134]

Given the low densities in many suburban areas, it is not surprising that travel patterns are affected. NPTS data show that those living in suburban and rural areas in 1990 traveled 26 percent longer to work (or for work-related activities) than those living in the central city. For non-work trips, those living in suburban areas traveled 10 percent longer, and those in rural areas 17 percent longer, than central city residents.

Suburban Employment Growth

In 1980, 23 percent of all jobs in the United States were in the traditional downtown but this percentage was lower the larger the city. For example, only 7 percent of all jobs were downtown in the 10 largest metropolitan areas. Between 1980 and 1990, most employment growth occurred in suburban areas, either in concentrated centers outside the traditional core or more generalized dispersion in low-density suburban patterns. In 1990, in the metropolitan New York area, only 5 percent of the work trips from the six most rapidly growing northern New Jersey counties were destined for Manhattan. In Bergen County, New Jersey, an older "bedroom" suburb for New York, employment grew 24 percent (or 80,000 jobs) between 1980 and 1990; the new jobs were filled by reverse commuters from New York, by a 33 percent reduction in workers commuting to New York, and by a substantial increase in workers from other suburban counties[135].

Joel Garreau, in *Edge Cities*, describes many of the concentrated suburban centers (which he calls "edge cities") that constitute a stage of urban development in American metropolitan areas which, he claims "has moved the central historic purpose of cities—jobs—to where people have been living and shopping for two decades."[136] In 1990, 18 of the 40 largest job centers in the United States were outside of traditional downtowns; moreover, all of the 18 had more jobs than downtown Pittsburgh. In 19 edge cities, as defined by Garreau, most residents live in buildings with ten or more housing units—for example, the Crystal City neighborhood of Arlington, Virginia, and Houston's Galleria area. Moreover, in many edge cities, there is a better ratio of jobs to residents than in the central city, which often leads to shorter average commutes.

TCRP Project B-6, studying ways to enhance suburban mobility, noted that,

> . . . while the emergence of suburban downtowns and edge cities have brought about more multi-centered settlement patterns, these patterns do not generally follow a well ordered central place hierarchy . . . The decentralization process in contemporary urban America is complex and not easily characterized, ranging from scatteration on one extreme to more ordered, central-place type hierarchies at the other, with small-scale clustering along corridors . . . occupying the middle ground.[137]

Pivo's study of six large metropolitan areas found that most office jobs were in relatively small, low-density clusters along highways or what he termed "the net of beads."[138] In the Los Angeles region, Giuliano and Small found that, although there were a few large suburban clusters, most suburban centers were small scale[139].

In Los Angeles, Gordon, Richardson, and Giuliano found that in 1980 there were 23 different "centers" which attracted a substantial density of trips (1.8+ standard deviation from the mean), with 19 accounting for only 17 percent of all jobs in the region[140]. Centers were defined as clusters of census tracks with job densities above 12,500 per mile. However, by 1990, the proportion of jobs in LA centers had dropped drastically so that only 7 percent of regional employment was in centers and the number of centers had dropped to 12[141].

Using the Bureau of Economic Analyses Regional Economic Information System (REIS) data files, Gordon and Richardson found that, from 1972 to 1992, substantial

employment decentralization occurred almost everywhere in the United States, with the outer suburbs reaching levels of employment previously achieved by inner suburbs[142]. Between 1982 and 1987 metropolitan employment growth was the highest in the outer suburbs for all industrial sectors except manufacturing; for example, it exceeded 3 percent in all metropolitan areas (except Milwaukee) and was over 5 percent in five large cities. This outer suburban employment pattern was not a Sunbelt/Rustbelt phenomenon—the highest rate of outer suburban employment growth in the United States was in four disparate communities: Houston, Detroit, Philadelphia, and Los Angeles[143].

Several different suburban trends are at work, several of which have different implications for transit use. Overall, metropolitan areas are becoming denser but this may be because formerly undeveloped land at the fringe is developed, existing housing stock has more inhabitants, and/or existing communities are redeveloped at higher density. It is difficult to gauge the relative strength of each trend without knowing the extent to which additional suburban employment growth will be in concentrated centers versus dispersed locations, the rate of population growth in close-in older suburbs versus suburbs on the fringe, or whether the increased number of people per housing unit within older suburbs (often associated with immigrant populations) will outweigh development in the outer suburbs. Growing land use costs and land use regulations will lead to more housing units per acre; the question is where this higher density development will occur and when.

Concentration of Central City Populations

Suburbanization has led to profound changes in central cities. The mass movement of American families and business to the suburbs has helped to create central cities which differ sharply from those of 50 years ago—in terms of the kind of economic activity and the kinds of families which live there.

Today, almost all U.S. neighborhoods characterized by extreme poverty are in the nation's 100 largest central cities. Moreover, the percentage of the population in central city census tracts living at "extreme poverty" more than doubled between 1970 and 1990, from 5.2 to 10.7 percent of the central city population. As the sheer numbers of the poor increase, they are being more concentrated not only within the central city but within small areas of the central city; the total percentage of the 100 largest central cities' poor populations living in extreme poverty tracts increased from 16.5 to 28.2 percent[144].

In 1980, 2.4 million poor people, or 8.9 percent of all poor people in the United States, lived in areas of concentrated poverty in a central city. In 1991, the poverty rate of all families was 17.2 percent in the central cities and 7.2 percent in the suburbs. Over 26 percent of central city families with children were considered poverty households compared with 11.9 percent of those in the suburbs—the ratio of poverty households to total households was 2.5 times as large in the central cities as in the suburbs[145].

The concentration of the poor has two major effects on an urban economy: the concentration of low-income households increases the per capita cost of public service provision and the pressure to provide these services creates substantial budgetary pressures on local governments which have a disproportionate share of the responsibility for service provision. Thus they are forced to raise taxes, which in turn accelerates the flight of higher income households and employment to suburban jurisdictions[146].

At the same time, the employment base in central cities frustrates attempts to decrease poverty by matching central city residents to central city jobs. Most central cities experienced absolute job growth but those new jobs are very different from those traditionally found in the CBD—there are few manufacturing or production jobs and many high skill information processing and professional jobs[147 148].

Thus low-skilled inner-city workers are disadvantaged by both the jobs left in (or coming to) the central city and by the movement of other jobs to the suburbs. As a result, they are often forced to seek the suburban jobs still matched to their skills and become reverse commuters[149]; generally incurring more expensive and longer commutes in both time and distance—with fewer and poorer transit options[150 151 152 153]. Many low-skilled jobs remain in the core of the central city; however, there are not enough to match all the low-skilled workers. Moreover, the skill needed for many low-skilled jobs is higher than that required in the past.

Between 1960 and 1980, the reverse commute, from central city to suburb, grew as much as did the central city to central city commute—8.5 percent—to constitute 8 percent of all commuter travel but over one-fourth of the trips of central city workers. In 1980, roughly five million American workers were traveling from the central city to the suburbs for work, more than double the 1960 number. Strikingly, 5.6 percent of all those workers used transit for their work trip (compared with 1.6 percent of workers living and working in the suburbs), despite the real disadvantages involved.

Some of these reverse-commute data represent people traveling a short distance to suburban employment concentrations just over the central city border, such as the Cities of Industry and Commerce, located very close to the traditional downtown of Los Angeles. However, these same figures undercount those living near the core of a central city like Oklahoma City or Jacksonville or Houston and commuting out a substantial distance without leaving the jurisdiction of the central city. The distances traveled by very-low-income people suggest that many of those with low job skills living in the central city are forced to commute some distance to suburban employment locations—whether or not defined as reverse commute.

Nationally, reverse-commute trips increased almost 9 percent between 1970 and 1980. However, these are aggregate

metropolitan figures: 25 percent of those living in the inner city were making reverse-commute trips in 1980. Moreover, some individual metropolitan areas experienced even greater changes in traditional commute patterns. A 1985 study found that, between 1960 and 1980, reverse-commute travel increased 66 percent in the Baltimore region[154]. A 1991 study in the Washington metropolitan area found that reverse commuting from the core increased 45 percent between 1980 and 1988, to account for one in five trips in the region in 1988[155].

Low-Density Neighborhoods

One of the signal features of suburbanization is low-density neighborhoods designed to separate homes both from one another and from any type of business or commercial activity. As a result, people must rely on cars to meet even their smallest needs; many trips that could be neighborhood-based in denser communities have now become very long.

Between 1983 and 1990, a remarkable array of trips taken for different purposes grew longer; every single non-work trip purpose except shopping grew in length. The average car driver or passenger in 1990 went almost 13 miles to visit friends, 11 miles to the doctor or dentist, and 7 miles to conduct personal business. Indeed, the average car traveler increased his or her mileage to school or church by over 25 percent, traveling almost 7.5 miles to go somewhere many people think of as "neighborhood-based."

Suburbanizing neighborhoods have their effect on older people living in the suburbs or rural areas as well; today, they travel farther and more often in a car than their central city counterparts. For example, all suburban women over 65 drove 6 percent more than central city women while suburban men over 65 drove 14 percent more than comparable central city men. The patterns are even sharper when the elderly are grouped by cohort; for example, suburban men 75 to 79 drive 20 percent more than their central city counterparts[156].

There has long been a debate over how much the way communities are structured creates the need for a car, particularly for non-work trips. In part to respond to the declining ability to use public transit or to walk in our current neighborhoods, neotraditional urban design advocates a return to more traditional, higher density, mixed-use neighborhoods. In such neighborhoods, transit and walking are viable options and required drives are shorter[157].

Most of these calls for new communities are based, at least in part, on research which shows that denser communities in the United States and around the world have lower car use and higher transit use. Unfortunately, it is unclear which attributes of those denser communities are linked to decreased auto use or increased walking or cycling, or if it is possible to manipulate or develop certain kinds of urban form or design neighborhoods in ways which will really influence travel behavior.

Analysts are hopeful about certain kinds of design changes and less sanguine about others. Critics have serious doubts about neotraditional design features: narrow streets and other changes in the streetscape that make automobile use less attractive, building at a more "human scale," and pedestrian amenities; many think that simple design features will not affect travel in a meaningful way, even if such features create a difference in whether or not people perceive walking as a realistic alternative to driving.

If neighborhoods are designed so that distances are short, major arterials are avoided, the orientation of commercial activities is carefully handled, and there is pedestrian circulation within commercial activities, residents will take more walking trips. Whether they will also take fewer auto trips or significantly change their entire travel patterns is still open to debate. The idea of redesigning neighborhoods to enhance accessibility and mobility is a promising one but requires additional research.

Migration

Most population growth in the last two decades has gone to the South and the West—with inherently lower metropolitan area density. The largest component of the U.S. population (34.3 percent) lives in the South while the Northeast region has the smallest share of the population (less than 20 percent). However the fastest growth in population has been in the Western region where many states showed double-digit population increases since 1980; Nevada grew almost 40 percent in the last decade while Alaska and Arizona grew more than 30 percent. In contrast, in the Southern region, West Virginia and the District of Columbia actually declined in population, while most of the rest of the Southern region grew less than 7 percent since 1980[158].

Much of these differences in population growth are because of migration—that is, people already living in the United States moving from one part of the country to another.

> High mobility underlies many fundamental institutions of American society; business. . . . the military, higher education, and more frequently the family. Young adults in the United States are highly mobile because they tend to leave home and live independently before marriage. In addition, Americans' older ages at marriage, low fertility, and high rates of divorce and separation, along with the growth in single-parent households, are consistent with elevated levels of residential mobility.[159]

The major internal migrations of this century were the movement of southern Blacks to the northern industrial cities and the movement of large numbers of people to the South and West, particularly California and Florida. In 1920, millions of poor Blacks left the rural South looking for better opportunities and jobs. As a result the distribution of the African American population changed—from one where over 90 percent of Blacks lived in the rural South to one where almost half did not[160]. After the Second World War,

> . . . migration streams flowing from industrial core regions to the southern and western periphery. Industrial cities became major sources of out-migration. The former periphery in the South and West (led by California and Florida) became the cutting edge of economic development and the hot spots on the migration map.[161]

Migration streams, for example, connected Florida with both New York and New Jersey as retirees moved there following World War II. Over time, however, the migration stream changed; between 1985 and 1990 there were as many workers moving to Florida from these states as there were retirees.

In the last decade, while migration to the South has continued, it has slowed to the West, particularly to California. Most migration in the past decade has been from the Northeast and Midwest to the South. So, despite disproportionate Western growth, some analysts believe that the "westward movement of the U.S. Population may be coming to an end" as internal migration slows; for example, net internal migration to the West was almost zero in 1988[162]. The most conspicuous indicator is that California, the principal recipient of westward migration in the last 40 years, has seen a marked downward trend in migration.

Within regions, most population growth has gone to metropolitan areas. Between 1910 and 1988, while the national population grew 167 percent, the metropolitan population grew by 449 percent—or more than 600 percent in areas over one million[163]. Metropolitan growth in the last decade has been almost 4 times that of non-metropolitan or rural areas. Moreover, the annual rate of metropolitan growth has been increasing over the last two decades—it was 1 percent in the 1970s; since 1984, the growth rate has been 1.2 percent[164]. (This was a sharp reversal from the 1960-1970 decade when nonmetropolitan areas grew faster.) Today, almost 80 percent of the total U.S. population live in metropolitan areas.

Conversely, a significant number of non-metropolitan areas lost population; between 1980 and 1988, 18 states (mostly in the Midwest) had one or more non-metropolitan counties which lost population. Nationally non-metropolitan growth overall fell to 0.3 percent annually but there was wide variation in growth rates. Almost 60 percent of counties in the Midwest and over one-third of those in the Northeast lost population in the 1980s. However, those non-metropolitan counties which were closely linked to metropolitan areas (for example, having a high level of commuting) generally had much higher growth rates and this pattern was uniform across regions of the country[165].

Not all parts of the country experienced equivalent metropolitan growth. Consistent with the regional population differences discussed above, metropolitan population in the West grew roughly 2 percent annually since 1980 while that in the Northeast grew less than one-half of one percent annually. Metropolitan growth in the South was the second fastest growing at roughly 1.53 percent annually[166].

Not surprisingly, the South and the West, housing half of the country's population, recorded 61 percent of U.S. employment growth between 1960 and 1980[167]. In themselves these patterns have transportation implications; in general, people have been moving from higher density industrial cities to lower density service-oriented cities. Even the goods-producing firms in the South and West have been able to locate in suburban areas to take advantage of cheaper land costs. As a result, the worktrip patterns of internal migrants may change remarkably—even if they keep the same occupation in the same kind of firm.

Overall, most internal migrants have moved from higher density places to lower density places. As such, they have generally moved from places where it is both possible and relatively easy to use transit, at least for the work trip, to communities where transit services, even for the work trip, are very limited. Unpublished data from the 1991 AHS show, for instance, that people of working age who moved to Phoenix were substantially more likely to move further out from the traditional core than those already in the MSA who moved.

Although low-density Southern and Western communities have some (relatively) high-density corridors and concentrated areas where transit services are practical and well-used, the overall movement of population from the Northeast to the South and to the West is not likely to lead to greater transit use overall or to increase transit's share of the market of any of the migrants—even among those more likely to use transit.

Immigration

The patterns created first by migration have been strengthened by immigration. Almost 40 percent of all immigrants live in the West: 43 percent of those from Latin America and almost 50 percent of those from Asia. In fact 4 of every 10 foreign-born persons from Latin America lived in California in 1988[168]. However, more of those born in Latin America lived in the Northeast (27 percent) than the South (24 percent). Census analysts attribute part of the regional concentration of those with different backgrounds to the ports where the migrants entered the United States.

> The Port of entry for Cuban-born immigrants is more likely to be Miami and hence their greater concentration in the South. For Mexican born immigrants, it is San Diego or El Paso and for East Asian-born immigrants, it is Los Angles or San Francisco, hence they are most likely to reside in the west.[169]

Not only are the South and the West the fastest-growing and now the largest areas of the country, they are also the home of large concentrations of recent immigrants to the United States—people who tend to have poor education and low-skill levels and who may be limited to low-end service-sector jobs. Immigration tends to produce concentrations of low-skilled and poorly educated workers who are competing

with comparable native-born workers for a declining number of low-end service-sector jobs.

The low levels of pay among immigrants alone may create a new market for transit operators; to the extent that these low-skilled migrants bring a "transit habit" with them, they may stay transit riders even as their lot improves. On the other hand, the dispersed nature of the jobs open to them, coupled with variable work schedules, may well pose substantial difficulties in providing useful service.

A recent University of Southern California study of immigrants in Southern California found trends similar to those found in national data (reported on in the Task 1 report); immigrants were more dependent on transit but rapidly became drive-alone commuters. Of immigrants' greater dependence on transit, Dowell Myers notes,

> . . . this modest transportation behavior is not a permanent characteristic of individual immigrants. Over time, recent arrivals adapt themselves to California society and improve their economic status. Their convergence on the commuting behavior of native-bornes is one demonstration of the immigrants' assimilation . . . Transit planners have been the unintended beneficiaries of a liberalized immigration policy and the post-1965 surge in immigration.[170]

The Effect of Demographic Trends on Current and Future Transit Markets

Public transit ridership in the aggregate will be negatively affected by many of the trends just discussed but strengthened by others. On the positive side, the growth of immigrants will have a substantial favorable effect, even in the absence of new services. The potential growth in young people and single-parent households might also lead to increased transit ridership, especially in the face of real income losses because of industrial restructuring.

The growing number of higher skill-level workers traveling to the traditional core of the city may also increase transit ridership; indeed, this group of higher income, generally more highly educated travelers create transit markets in several different service environments. The growing number of elderly people, many of whom are more dependent on transit today and who may be less sensitive to time constraints in the future, may also increase overall transit ridership.

However, it is not clear that transit will capture a larger share of these growing market niches, even if transit increases overall transit ridership. Most of the other societal trends are likely to have negative effects on transit ridership—in the absence of new or different services—even among most groups proportionately more likely to use transit and even if the total population within each group increases.

First, the aging of the population may increase transit ridership but only for a short time, in the absence of new service arrangements, even though older people constitute a strong transit market. One reason is that most higher ridership by older people is probably a generational artifact; there is no evidence that people rely more on transit as they age. It is more likely that the higher transit use now seen among the elderly reflects the "transit habit" of a previous generation. Moreover, almost all older people will be licensed in the near future and most will live in suburban or rural communities with few alternatives to driving alone. Although older people who are poor may continue to disproportionately depend on transit, the percentage of older travelers who are poor has declined substantially.

The NPTS data support this conclusion, showing that transit ridership among the elderly fell faster from 1983 to 1990 than for almost any other group of people[171]. In addition, suburbanization increases the distance which people have to travel to get to and from a bus; older travelers are less likely to be willing or able to walk to transit stops. So as the non-transit habituated population ages, transit use among older people will drop substantially.

Second, the growth in the number of households is linked to the growth in per capita car ownership; that growth rate alone poses serious problems for transit operators. Once any traveler has purchased a car, the marginal cost of additional trips may be small; the cost of driving may even be perceived as less than the cost of a transit fare.

Third, the growth in the number of single-parent households may increase transit ridership because so many are poor. However other societal trends act in ways likely to lead to lower market share among single parents. Both Census and AHS data presented in the Task 1 report show that poor women (those with incomes less than $20,000) were substantially less likely to use transit than comparable men. Moreover, women with incomes less than $5,000 were less likely to use transit than those with incomes of $15,000; conversely they were more likely to drive alone to work. These patterns may reflect the continuing suburbanization of the low-skill jobs available to many single female parents, the need to reverse commute, as well as the demands created by balancing work and home without a resident partner. So again, while total transit ridership may go up as this group increases numerically, transit will probably capture a smaller and smaller share.

Fourth, suburbanization coupled with the migration to the lower density West and South by residents and immigrants will work against transit use. Residential suburbanization supports the deconcentration of industry and business leading to widely scattered job sites and widely scattered residential locations, neither well served by traditional transit options. Transit may increase total ridership from the growing number of low-income reverse commuters, but—in the absence of new service arrangements—it is also likely that transit will lose market share among those reverse commuting, because these trips are often the most difficult to take using traditional transit alternatives.

At the same time, of course, there will be some increased densification within suburban areas and the development of

some fairly high-density suburban employment centers, as typified by the Houston Galleria or Tysons Corner outside Washington, DC. Workers traveling to these kind of destinations may be more willing to use public transit, but generally only if they live in areas with the density needed to support acceptable levels of transit.

Finally, the aggregate trends described above will not have the same effect in all communities or on all current or prospective market niches. First, aggregate or national figures often blend what is happening in low-density western and southern areas with what is happening in older, denser, mid-western or northeastern areas—giving "averages" which accurately describe no one. Second, and more importantly, every community is different; the same trends which reduce ridership in one community—such as suburban development—may help create new market opportunities in another community—for example, densification in older suburbs or concentrated suburban employment centers.

SOCIAL FACTORS

Three complicated sets of responsibilities and perceptions underline the travel patterns of most Americans as a result of many of the trends previously discussed:

- Family support relationships,
- Division of household responsibilities, and
- Perception of crime.

Family Support Relationships

Those currently of working age have been called the "sandwich generation" because they may have responsibilities to both their children and their parents at the same time. This situation arises because many people have delayed the birth of their children while their older parents are living longer. A 50-year-old woman could easily have both a 15-year-old child and an 85-year-old parent. In fact, the ratio of those 50 to 64 to those over 85 has tripled since 1950 and will triple again over the coming 60 years[172].

This has created a situation without historical precedent; in 1940, only 1 in 3 50-year-old women had a living mother—that figure had doubled to 2 in 3 by 1980.

> More people will face the concern and expense of caring for their very old, frail relatives because so many people now live long enough to experience multiple chronic illnesses . . . the oldest old [those over 85] are the most likely to have pressing needs for economic and physical support.[173]

One of the major implications of the growing percentage of the population over 65 is that there will be fewer and fewer younger workers available to pay for, or to directly provide, services for those seniors who increasingly require assistance—including transportation or services which take the place of transportation. The changing population structure has both a societal and personal dimension; at a societal level there are fewer people to support governmental programs while on a personal level there are fewer people to provide individual assistance. Those living alone may be particularly needy—and far less likely to receive assistance from non-governmental sources.

While the ratio of those over 65 to those 16 to 64 will actually drop—that is, get better—in the next 15 years as the disproportionately large group of baby boomers provide personal and societal support for their parents, in the subsequent two decades, the ratio will climb substantially—that is get worse. This worsening of the dependency ratio is the result of the aging of the baby boomers which leaves fewer younger people to pay for needed services. In 2030, when the last of the baby boomers leaves the workforce, there will be more than 83 dependent people to every 100 working age adults[174]—or almost 50 percent higher than 1990.

Several studies have shown that "intergenerational linkages" between older people and their younger relatives has been decreasing for years. Between 1962 and 1982, the number of elderly people who saw one of their children at least once a week decreased 25 percent. There has been an even greater decline in the number of men providing household repairs and women providing domestic help to their aging parents. Most experts see these trends resulting from the substantial increase in the employment of daughters and daughters-in-law as well as the high level of divorce, which weakens intergenerational links[175].

How to pay for as well as provide appropriate services, including transportation, is an important societal concern. For example, because the distribution of older people, particularly the very old, is not evenly divided across the states, several states will be in the position of having large numbers of both very young and very old people who may need special services. Four states projected to have the largest percentage of the population under 20 by 2010 are also the states projected to have the highest percentage of the population over 65: California, Illinois, Michigan, and Texas.

The personal dimensions of providing assistance to an aging population are also significant. A 1990 study found that almost one in five men and one in three women older than 75 required assistance to conduct some of their daily activities (such as bathing, dressing, or eating)[176]. Between 80 and 90 percent of this kind of personal care, as well as help with household tasks—including transportation—are provided to the elderly by family members, usually daughters and daughters-in-law[177 178 179 180].

The need of people, and particularly women, to care for older people has transportation implications. The overall level of care required by our rapidly aging population is much more physically and psychologically demanding than that needed four decades ago, in part because of the increased number of cognitive diseases among the growing number of people older than 80. At a minimum, the needs of their

elderly parents will constrain the schedules and travel choices of many women relatives, particularly those in paid employment; at the worst, middle-aged women may actually leave the workforce to care for frail older relatives[181 182].

These caregiving activities affect the transportation patterns of both the caregiver and the older person. Families, and older people themselves, may vary in the degree to which they offer rides to others, accept rides instead of driving or staying at home, or accompany family members on a bus or public transit vehicle. Differences in cultural norms about family support may affect the amount of assistance offered to older people to help in carrying out their daily activities; these norms may equally affect the kind of help older people expect from friends and relatives (either the kind of assistance which reduces their own need to travel, or the offer of a ride or escort when travel is required). Because most caregivers are employed, these patterns will ultimately affect the commute mode they choose as well as their trip-linking behavior.

Division of Household Responsibilities

Women in two-worker families are generally assumed to be performing most of the childcare and domestic responsibilities; this is reflected in their travel patterns. However some researchers have questioned whether men with employed spouses, particularly younger men, will take on more caretaking responsibilities, altering their travel schedules—and perhaps those of women whom they are relieving of such obligations.

Several researchers have found that men are spending more time with their children and doing more housework than comparable men a decade before. A recent article in the *Wall Street Journal* reported that,

> Most couples today are in what sociologists call the transition stage—evolving between "traditional" roles, with women taking sole responsibility for homemaking and "egalitarian" roles with men and women sharing equally the burdens of homemaking and earning money.[183]

A 1993 study concluded that, in the last three decades, men have spent more and more time on household activities; between the early 1970s and the mid-1980s they did more "traditional male tasks" such as household repairs and lawn care. Since 1985, men have also helped more with what the researchers call "female tasks," such as cooking, cleaning and laundry[184]. But part of what fueled the closing gap was that the total time a household spent on domestic responsibilities declined as women entered the labor force; men, therefore were doing a higher proportion, but of less work.

A 1988 study found that male household responsibilities have changed to accommodate the employment status of their wives—men in households with a non-salaried wife contribute 30 percent less time to household duties than those with a salaried wife. However, the same study found that husbands still carry only a third of the household task load, even when the wife has full-time salaried employent[185]. In fact, most studies still find that women, even when fully employed outside the home, take on most household responsibilities[186 187].

A study of panel data from the Michigan Study of Income Dynamics for the years 1979–1987 found that large disparities in the time spent on housework between men and women have continued, even when the wives are also in the full-time labor force. In households in which both spouses had paid employment, men averaged 7 hours per week on housework while women averaged 17 hours—in no case, did men conduct, on average, more than 29 percent of all household activities. When there were children present, working women averaged 23 hours per week of housework while men still spent 7 hours per week on all household activities[188].

The Michigan data also showed that the more a man earned, the less he worked around the house; while women also decreased the amount of housework they did as their income went up, men's household activity dropped at a faster rate than comparable women's. In addition, while employed women's household activity was inversely related to the hours their husbands worked outside the home, the number of hours worked by women had no effect on the amount of housework which her husband did[189].

Data from the 1987 National Survey of Families and Households indicated that employed women put in an average of 33.8 hours per week in household labor while employed men, by their own report, averaged less than 19.1 hours per week of housework. If the paid labor of both sexes were added to household work, men worked 52.6 hours per week while women worked 67.4 hours[190]. A study based on Dutch panel data found that the partners of employed women did not increase their "maintenance" activities when their wives worked; moreover the presence of children had more effect on female workers than male workers, clearly increasing maintenance activities by women[191].

An analysis of 120 households from the 1991 data Boston Region Household-Based study showed that while men and women in households with workers had significantly different allocations of time for various activities, the differences were generally less when both men and women worked[192].

Most transportation studies still show little evidence that men are taking on substantial domestic responsibilities in ways that affect their travel patterns[193 194 195 196], although such responsibilities seem clear in the travel patterns of women. A 1992 survey in Southern California found that employed women were more than twice as likely as employed men to report needing a vehicle to take children to daycare and school[197]. A 1990 study in four Chicago suburbs found that employed women made twice as many trips as comparable men for errands, groceries, shopping, and chauffeuring children[198]. An analysis of the 1994 Portland, Oregon, activity and travel survey found that women heads of household per-

form more activities, travel more, are more likely to link trips together, and tend to tie more trips into trip chains when they do link trips than comparable men[199].

The 1994 Portland study found the more that men worked outside the home, the less they engaged in maintenance activities—and the more their spouse did. While the study also found that the more that women worked out of the home the less discretionary travel they engaged in, they found no change in the travel patterns of their male partners. The authors concluded that even among employed women, there "are important gender role differences" which are reflected in their travel patterns[200].

Analysis of 1990 NPTS data shows that neither marital status nor the presence or age of children in the household had any effect on the travel patterns of husbands while having substantial effect on the travel patterns of wives. Men in two-adult households made 3.2-3.3 person-trips per day regardless of any other factor; women with small children made 3.5 trips a day (or 9.3 percent more than men with the same responsibilities) while women with children 6-15 made an average of 4.0 trips per day (or 21.2 percent more than comparable men)[201].

Given the need to respond to children in an emergency, to chauffeur those children needing rides, and to conduct much of the personal business supporting a household, it is not really surprising that women have been abandoning transit in droves—even though they are more dependent on it than comparable men. At the same time, as a result of the often lopsided distribution of household responsibilities, comparable men are free to become or remain transit users. This is probably part of the reason that transit ridership is higher among some groups of men than among comparable women.

But if household duties are becoming more evenly distributed—as may happen among younger workers—both parents may be precluded from using public transit. The responsibilities which require women to drive alone, for example, might just as easily require men to drive alone, rather than rely on transit. The best transit scenario is that one parent would agree to conduct all domestic and childcare-related travel on one day, taking the car while the other parent took transit. A far worse scenario is that the parents will equally divide the domestic travel each day so that both would need to drive to work.

Perception of Crime

Many Americans are fearful of walking to transit stops, waiting there, or riding on transit vehicles. Statistics on the actual incidence of transit crime are unsatisfactory because of the way such crimes are reported. In general, an assault or other incident is only considered "a transit crime" if it happened on a vehicle or in a station; if a crime is committed while a person is walking to or from a bus, or waiting at an ordinary bus stop, the crime is rarely categorized as having anything to do with transit.

However, actual crime statistics are probably not the issue; studies have found that perception of crime is more important than actual crime rates in motivating people's behavior. In many studies, women have reported being more fearful on transit vehicles, waiting at stops, or walking to or from a station; a disproportionate share of older women report such concerns. Several large employers or Transportation Management Associations (TMAs) have surveyed workers, asking why they will not or cannot use alternative modes like the bus; women are 2 to 4 times more likely to report fear for their personal safety as a reason in their mode choice[202 203].

Transit systems are affected by being part of a society in which personal crimes against people are significant. These fears are part of the reason why the growing number of female service workers have not used transit more frequently. For example, it is not uncommon for women who do use transit to report riding the bus only during the summer when it is light when they go home, or only to work—but not home from work.

To be able to reach several large and overlapping markets, such as elderly women or service workers who may work late night or all night shifts, transit operators will have to alter their services or facilities in a way that actually keeps riders safe and convinces them that they are safe. In the absence of such service changes, the perceptions of street crime will act to lower transit ridership even among groups seen to be disproportionately dependent on transit today—including young workers, women, and the elderly.

Impact of Social Trends on Current and Future Transit Markets

The social trends just described—family members caring for older parents, people being afraid of traveling, and working parents (particularly salaried mothers) having multiple responsibilities that constrain their mode choice—all have a net negative effect on fixed-route transit ridership. Overall, a lower percentage of elderly people will be inclined to use public transit; as their mobility declines their children and younger relatives will have to transport them. As a result, transit ridership may not only drop among the elderly but among their caregivers as well.

LAND USE FACTORS

Intensity of land use has a profound influence on transit markets; density of dwelling units and population are associated with trip production while density of employment influences trip attraction. This section focuses on recent changes in urban land use and how these changes have, and will,

influence existing and emerging transit markets, focusing on the following four specific issues:

- Decreasing population density,
- Decreasing employment density,
- Increasing downtown employment density, and
- Increasing density in older suburbs.

Although improvements in transportation have structured land use in previous decades, this is no longer true in most American cities. The overall level of accessibility is so high that any improvement resulting from transit can cause only micro changes[204 205]. These micro changes, however, can still create potential transit niches and markets.

Evolution of American Cities

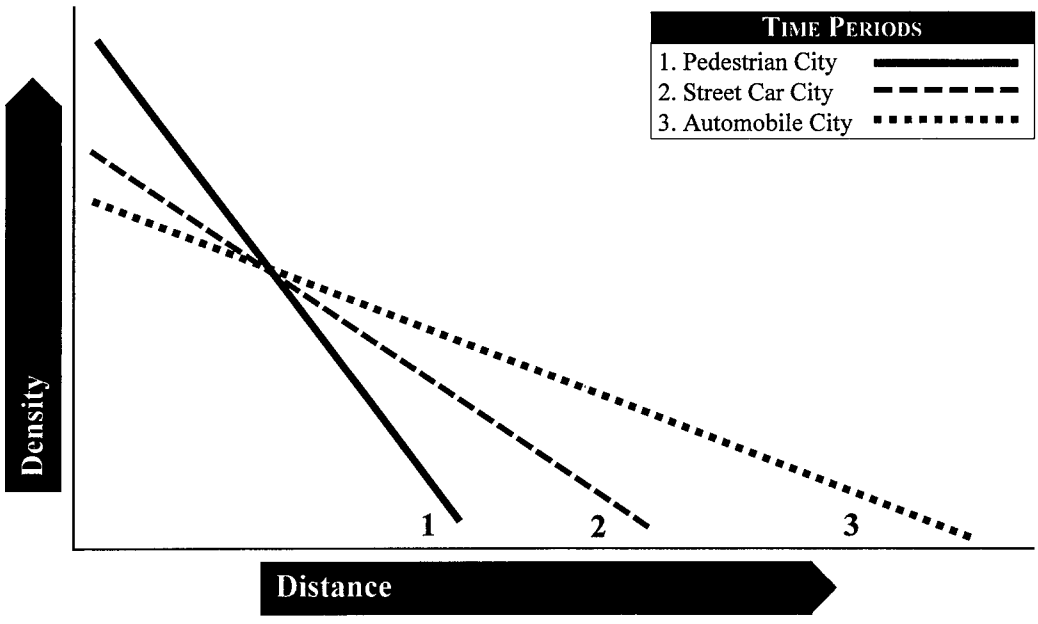
Land use in American cities has changed over time resulting from technological developments that have reduced the cost of travel, and most cities continue to reflect these patterns of sequent occupance; these are illustrated in Figure C-4. In the early decades of the nineteenth century, most people walked, and the condensed, monocentric city developed from the principle of reducing the number and length of trips required. This monocentric pattern survives at the center of the modern metropolis.

Introduction of the horse-drawn omnibus in the 1840s and later horse-drawn trams increased travel speed. This allowed workers to live further from their employment and facilitated development of "districts" devoted to residential and industrial uses. Commercial use remained concentrated downtown—the location of maximum accessibility.

Invention of the electric streetcar in the late 1880s brought a quick end to the construction of tram lines. Faster streetcars permitted longer commute trips and allowed increased separation of home from work. This was also spurred on by the noxious environmental effects of industries. Suburban convenience centers, which developed at major stops, resulted in a linear development along the streetcar lines. But suburban commercial zones were still "united" with the more specialized commercial activities in the city center by the termini of transit lines. Major purchases, and most business decisions, were made in the central business district (CBD).

Adoption of the automobile in the 1930s, and even more dramatically, following World War II, transformed accessibility. No longer were commuters tied to linear streetcar and commuter rail lines; traffic congestion ruined the accessibility advantages of the central city. Both shoppers and businesses began to avoid going downtown because congestion costs lessened the accessibility advantage. Low-density neighborhoods were constructed, competing commercial centers developed, and industry began to relocate from older multistoried, central city buildings into suburban industrial parks accessible by automobile. The multi-nucleated city was the result. The relative importance of the downtown has been reduced, but it persists as the largest and most specialized center for business employment.

Chicago epitomizes the sequence of urban activities. Downtown—the CBD, within the "Loop" of rapid transit



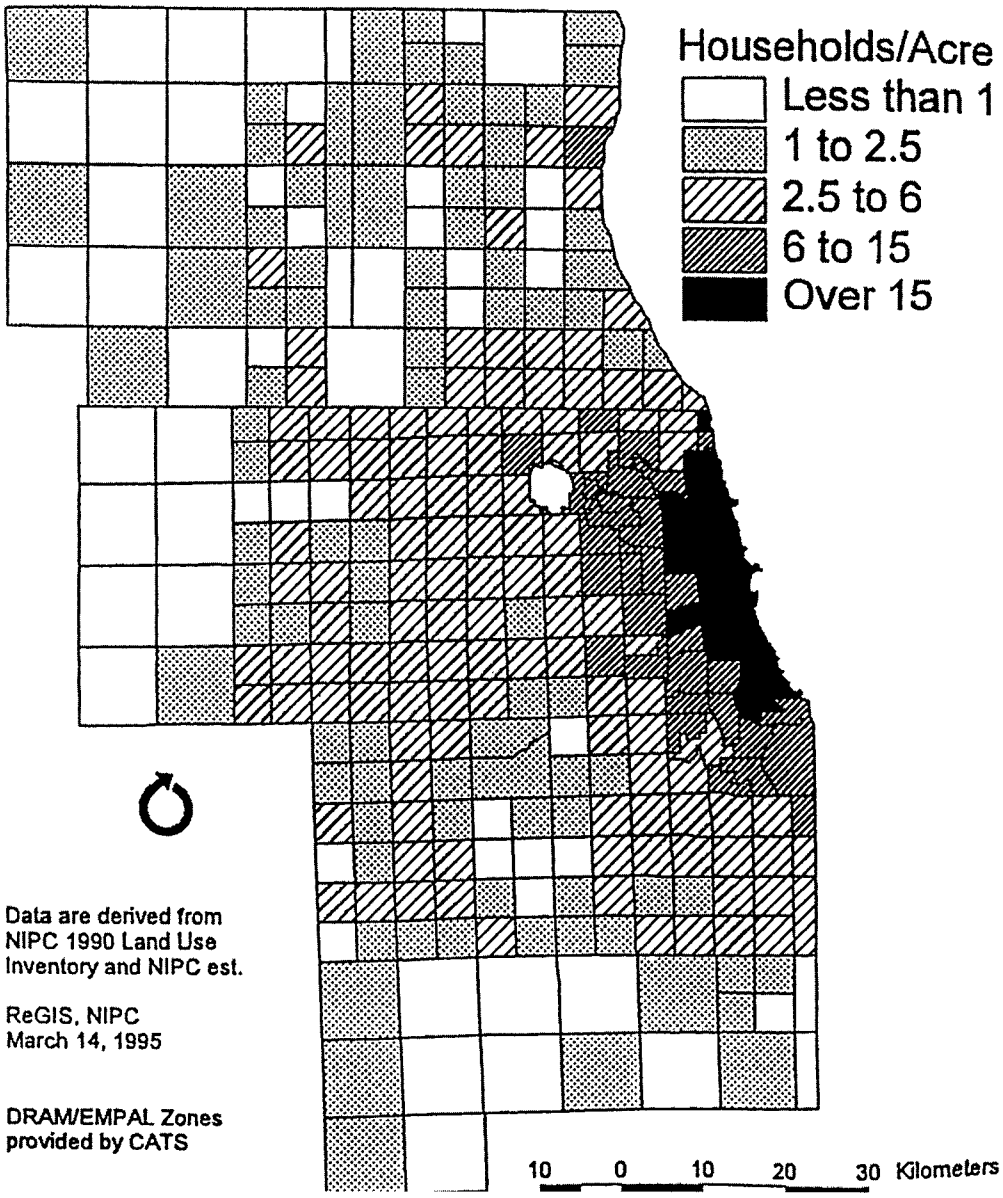
Note: Converting density and distance to logarithms creates a strait-line, density profile. The density gradient flattens out over time with changes in technology that allows workers to move to less-dense, suburban, residential areas.

Figure C-4. Population density gradients in American cities at different time periods.

lines, and the near West and South sides—contains 63 percent of commercial office space. Immediately surrounding the central core of high-rise buildings are the original suburbs. Some have preserved their nineteenth century charm, but most of the two and three storied walk-up flats have been replaced by public housing—now in the process of conversion to private ownership. High densities (over 15 dwelling units per acre) prevail as shown in Figure C-5.

Population densities exceeding 60,000 per square mile are frequent with more than 10 percent of residents over the age of 65. Corridors of median residential density (6-15 dwelling units per acre) remain in suburbs along streetcar (now rapid transit) lines to the north (Evanston and Skokie), west (Oak Park and Cicero), and south (Englewood and Jackson Park). But the most extensive transformation has occurred beyond the streetcar suburbs and adjacent to the freeway suburban centers of Oakbrook, Naperville, Hoffman Estates, and Schaumberg.

There office, research and shopping plazas are surrounded by bookstores, coffee shops, restaurants and parking lots.



Note: Patterns of high and low density of dwelling units reflect the evolution of Chicago land use in association with changes in transportation technology. Source: Northeastern Illinois Planning Commission

Figure C-5. Population density of dwelling units in northeastern Illinois, 1990.

Residential density is low—less than six dwelling units per acre—and schools, universities, golf courses and forest preserves occupy extensive areas. Downtown persists as the dominant commercial center, but its role is challenged by suburban central places and strip malls that are more conveniently located to serve the needs of suburban customers.

The entire Chicago region has been transformed by these redistribution trends. The Northeastern Illinois Planning Commission reports that between 1970 and 1990, the region's population grew by a modest 4.1 percent while the amount of urban land increased by 47 percent. During this same period, Cook County, the core of the region, lost population. But new trends are increasing population densities in some of the inner suburbs. Skokie and Cicero, for example, are gaining households and increasing population density with the arrival of migrant households.

Similar transformations have occurred in most American metropolitan areas. Although overall density has declined as activities have dispersed, concentrations of people remain in central cities and the older suburbs and these people provide both an existing and potential market for transit. For example, in Cook County, Chicago, 19 percent travel to work by transit while 4.7 percent walk and use transit occasionally. Availability of transit for social and medical travel is even more critical. Some 404,000 households (21.6 percent) do not own an automobile.

Communities are beginning to rethink the way in which they will allow growth to occur. Unfettered sprawl burdens tax payers with higher costs that have been borne by the federal government. If these costs were shifted back to state and local governments, public agencies might seek to make more efficient use of land already developed by allowing higher density, residential development.

The Role of Population Density

Although density is positively associated with transit patronage, density is actually a surrogate for other population and economic characteristics that create a demand for transit. Pushkarev and Zupan describe these relationships, but have been criticized for conclusions they drew from their analyses[206]. Their data show that transit use increases with residential density; low residential densities are associated with marginal use, but use increases in medium- and high-density areas. Densities of 7 to 30 dwelling units per acre were described as necessary to sustain significant transit use—in the range of 5 to 40 percent of all trips. Additional evidence was provided for the role of density of attraction. A strong, positive relationship between percent of persons using transit and the magnitude of office space in the largest CBD was shown. Regions with substantial employment in the central locations were described as likely to be more successful in sustaining fixed-route transit than those where employment is dispersed.

Conclusions based on the Pushkarev and Zupan analyses have been criticized, but the density relationships they proposed have not been rejected. Handy and Cervero criticize the aggregated nature of the data used and point out that density is merely a surrogate for socioeconomic variables that are more influential[207 208]. And Hanson and Schwab suggest that low-income and pedestrian-oriented neighborhoods are the true determinants of transit demand, and these tend to be correlated with high population density. Although these criticisms are justified, they do not invalidate the relationships between density and transit demand that is helpful when seeking to understand the association between land use and potential transit markets.

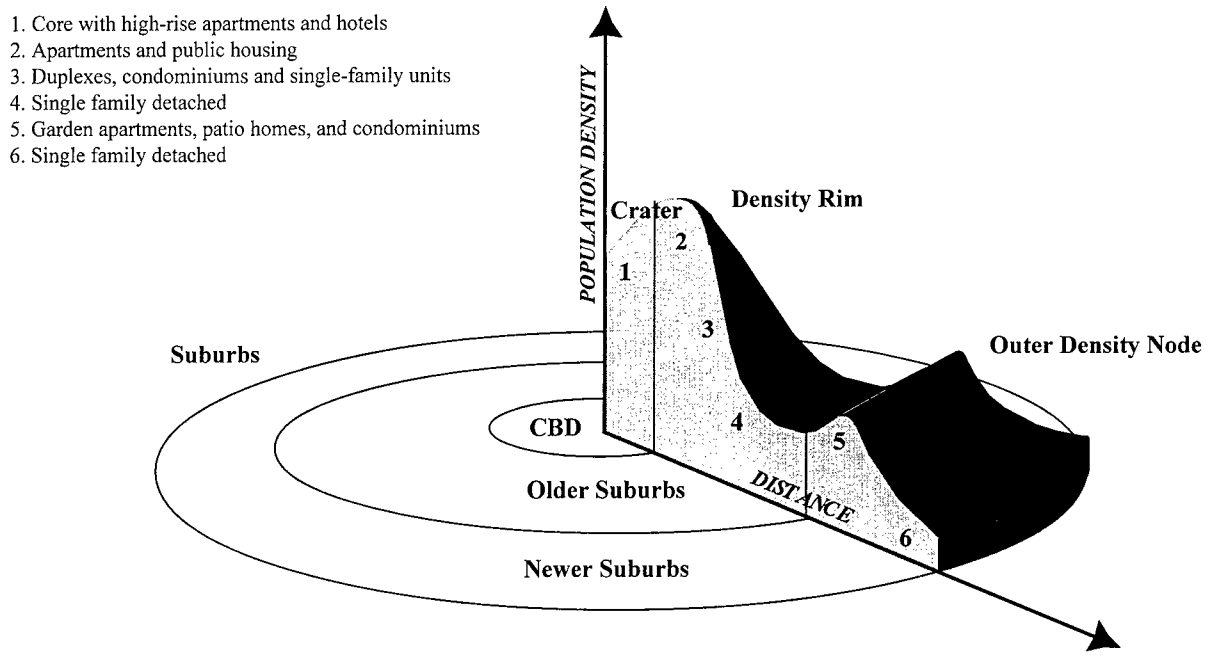
Neither Pushkarev and Zupan nor their critics adequately controlled for the level of transit service available. Thompson used 1990 data for Sacramento, California, to analyze the Census tracts[210]. The size of a tract's population was significant in explaining the potential for producing trips and employment density had, by far, the most influence of the variables explaining attraction potential. Because of the variation in the area of census tracts, absolute magnitude of population, rather than population density, was the significant variable explaining potential trips. The importance of density, however, is revealed when only the more compact, census tracts adjacent to downtown Sacramento are examined as shown in Figure C-6.

Increasing Population Density

After many decades of decline, population density in urbanized areas is beginning to increase. In Task 1, transit agencies were grouped into transit markets using population size and density for 1990. Surprisingly, placed together with agencies from New York in the highest density category, were agencies from the Los Angeles and Miami urbanized areas. And the medium density areas include agencies from newer areas such as Portland, Sacramento, and San Diego, as well as those in Boston, Chicago, and Philadelphia. Redevelopment of outmoded houses, constructed following World War II, together with the arrival of immigrant populations, have increased density in urbanized areas that experienced high population growth during the 1980s.

Increasing density is most apparent in medium-sized metropolitan areas with about one million inhabitants. Their population density gradient is steeper, because their inner neighborhoods have not deteriorated, and more people dwell closer to the center. In addition, their downtowns frequently contain regional offices for financial, legal, and administrative functions who employ large numbers of middle-income workers on regular schedules. Hartford, Albany, Buffalo, Columbus, Cincinnati, Sacramento, Portland, and Honolulu are examples. The older cities adjacent to the City of San Diego illustrate the changes that are occurring as seen in Table C-6. Population density in Chula Vista, El Cajon, La Mesa, and National City are increasing to the level which can sustain fixed-route transit.

Changing population density has been a feature of American cities. This is continuing and provides potential



Note: Few people dwell in the CBD; density at first increases with distance (to the density rim) and then declines in the older suburbs. Another cone of density develops adjacent to "edge cities," while density is much lower in the new suburbs. As the area for development is larger in the newer suburbs, there is less competition for residential land, and densities are lower. *(Adapted from Hartshorn, 1992)*

Figure C-6. Density in a major metropolitan area, diagrammatic representation.

markets for transit. The pedestrian city of the early nineteenth century was compact and the density gradient was quite steep with distance from the city center as Figure C-6 indicates. Streetcars facilitated the dispersal of residents although many commuted to work in the central city and adjoining industrial suburbs. Use of the automobile for commuting allowed families to travel farther and move away from rail-oriented, suburban centers; density gradients were lowered because central cities, congested by traffic and afflicted by air pollution, became increasingly unattractive as residential areas.

Newling showed that population densities in modern American cities are not highest at the center, but in a ring around the center[211]. His model resembles a volcano with density peaking about a mile from the city center and declining further outward, as shown in Figure C-7. There is a population density crater at the center, and then a rim that merges with a somewhat, steeply-declining curve (cone) towards the outer suburbs.

Canadian cities differ from American cities in the rate at which population density declines, because population in the central suburbs tends to increase proportionately with that in the outer suburbs. The gradient away from the density rim is more gradual for two reasons: first, the large number of immigrants who came to Canada in the 1950s and 1960s located in the central cities and replenished the population density, and second, houses are more expensive. Higher down payments are required in Canada, and interest charges on housing loans are not deductible from income taxes. Households move less frequently, are satisfied with less living space, and cities do not discourage multi-household dwellings.

Some older American suburbs, like those described for Chicago and San Diego, are experiencing societal trends similar to those in Canada. As population growth occurs—caused largely by immigration of Hispanic and Asian families—older suburban cities, where these families choose to cluster, are becoming more tolerant of shared housing, and willing to allow increased density by rezoning areas for multi-family redevelopment.

Garden Grove, in Southern California is a prototypical example. Founded in the 1920s adjacent to a streetcar station on the Pacific Electric Railway, it was an agricultural center until the 1950s. As housing tracts were begun, Garden Grove incorporated as a city in 1956 and by 1960 had a population of 84,330 with a density of 4,560 persons per square mile.

There was little change in density until the early 1980s when Korean businessmen from Los Angeles began to purchase the aging tract houses, converting them to multi-unit dwellings and expanding commercial lots into strip malls oriented to an Asian clientele. By 1990, population density had increased to 7,730 per square mile with highest concentrations adjoining arterial streets. Units in medium- and high-density residential areas now account for 35 percent of the housing.

TABLE C-6 Population density per square mile for inner cities in San Diego County, California, 1960–1990

	Year			
	1960	1970	1980	1990
Chula Vista	4723	4782	4742	4991
El Cajon	3839	4393	5242	6422
La Mesa	4756	5023	5528	5832
National City	5852	6748	6774	7554

The steady increase in population density has accelerated between 1980 and 1990, with the arrival of additional Hispanic households.

As a result of increased density and changed social composition, bus routes traversing the area have become some of the most productive in Orange County. Changing occupation of land, similar to that which has occurred in Garden Grove, is happening in other urbanized areas and offers opportunities for transit agencies to expand markets by restructuring routes and schedules to accommodate the different travel needs.

Land use in the contemporary metropolitan area exhibits the sequence of occupancy that has occurred. The research team has chosen to illustrate these changes in terms of population density because density is associated with the production of transit trips. Population density is highest in the rim of older apartments and public housing that surrounds the CBD. It then declines in both directions—toward the center, commercial use predominates, and, as is typical, density declines steadily as one moves farther from a city's center.

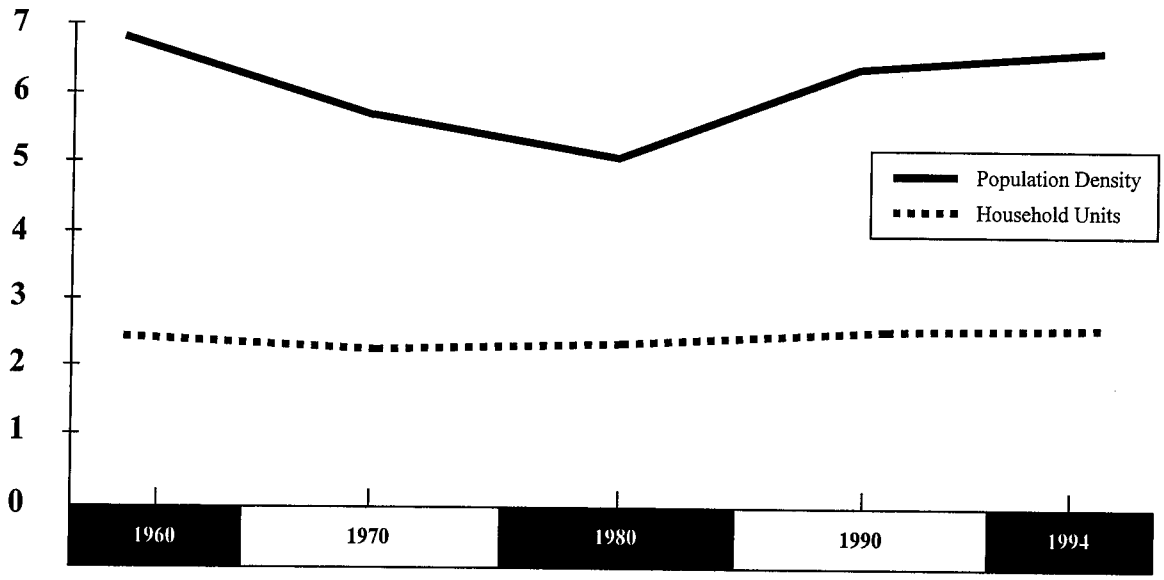
Population density increases at nodes on the edge of the central city where perimeter beltways intersect arterial freeways and transit lines. Increased density results from the clustering of apartments and condominiums near "edge cities" offering employment opportunities for research, education, recreation, and administrative activities. Single-family dwellings extend beyond the nodes of outer density and merge with the rural fringe.

For transit markets of the future, changes occurring in older suburban areas present an opportunity. As residential density increases, more residents will be within walking distance of transit stops, making them more likely to use transit. The challenge, however, will be to determine what activities will attract them and where will these be located.

Employment Density

Employment opportunities are dispersed widely throughout the metropolitan area. The societal trends presented earlier in this chapter are likely to expand the dispersal process by continuing the

- Suburbanization of employment;
- Contracting out of industrial production to small, specialized factories;
- Growth of the flexible workforce;
- Expansion of home or out-of-car working; and
- Improvement in communication technology.



Source: Derived from data from Sacramento Area Council of Government

Figure C-7. Population density and housing units in the southern section of Sacramento, California, 1960–1994.

Commercial employment in metropolitan areas exhibits a central place hierarchy. A network of commercial centers (central places) is created by the consumer's need to access different functions and the willingness of firms to supply these goods and functions. For example, high order goods, like special legal representation or fashion clothing, are seldom required and are in the CBD together with superior courts and specialist advertising agencies. The CBD offers both the largest number of functions as well as the most specialized; it is the highest order center in a network of central places.

Regional centers compete with the CBD by offering goods like clothing, professional services, and entertainment that consumers require occasionally and for which they are not willing to travel to the CBD. And nested within the service territory of each regional center are several neighborhood centers (lower order central places) providing goods that are required most frequently—groceries, health supplies, doctors, and dentists—which are more convenient if nearby.

A true nested hierarchy of commercial land use and employment seldom occurs. Accessibility by auto has facilitated the development of commercial strips that compete with neighborhood and regional centers because of their superior access. And automobile dealers and doctors have found it easier to attract customers by agglomerating similar services into auto malls and medical plazas. Nevertheless, the central place model does explain the major clusters of commercial land use that transit agencies use as regional centers. Some recently established agencies, like the Orange County Transportation Authority in California, have planned their bus network using the hierarchy of regional centers as transfer locations.

The CBD remains the single largest and most specialized employment center. A survey of 60 large metropolitan centers, summarized by Sullivan, found that, although CBDs averaged only 17 percent of total employment, they retained 24 percent of the specialist jobs in finance, insurance, and real estate (FIRE)[212]. Only 10 percent of retail employment remained in the CBD. TCRP Project H-3 studied more than 1,000 U.S. cities in 1990 and found that employment in FIRE sectors was positively associated with increased transit use; a 10 percent increase in this sector's share of employment increased transit ridership by roughly 3.5 percent. The authors conclude that this type of employment has remained in central locations, easily served by transit[213].

> The combination of distance and the costs of congestion, especially in those downtowns without rapid transit, has allowed regional and specialty centers to compete for activities that formerly clustered in the CBD. Even in Los Angeles, the prototypical dispersed city, the Downtown core continues to be the largest of 29 employment centers with almost half a million employees.[214]

Industrial areas are even more dispersed than commercial activities, and there is little incentive for modern industry to cluster so as to facilitate travel by public transit. Location adjacent to port and railroad terminals once reduced costs for industry, but since the advent of freeways and increased truck haulage, the advantage of these sites has been reduced.

Agglomeration economies—having parts suppliers near manufacturing plants—remain essential in the automobile, machinery, and electronic industries. But "just-in-time" deliveries can be maintained without proximity. Agglomeration

economies still facilitate regional specialization so that industrial firms can access trained labor and consultants in financing and marketing, but with telecommunications, these advantages do not require proximity.

Manufacturing of clothing is an exception; piecework by contractors, access to specialized cutters, and design and marketing consultants is facilitated by agglomeration in garment districts. And the need for access to workers, willing to accept low wages results in the concentration of clothing factories near the CBD. Some 12 percent of manufacturing employment remains in the CBD. Because these employees are primarily low-paid, they provide an important market for bus transit.

Impact of Land Use Trends on Current and Future Transit Markets

The link between transit and land use is indirect; residences, stores, and factories do not make trips, people do. The density of dwellings is influential, because this creates an aggregation of people, some of whom are willing to use transit when service is convenient, fast, and safe. Density of attraction to employment opportunities at commercial and industrial sites, and to social and educational facilities, is more influential than residential density when explaining travel by transit. But, as these land uses have become increasingly dispersed, transit has lost markets to autos which have given individuals metropolitan-wide choices for shopping, employment, education, and social activities. Transit has been reluctant to serve these dispersed markets as well as it has served downtown.

Some of the significant trends that affect transit use are

- Changes in land use have been closely associated historically with improvements in transportation technology.
- Population density provides a surrogate for the socioeconomic variables that influence demand for transit.
- Older, transit-oriented neighborhoods could produce 3 to 4 times as much transit traffic as newer, post-World War II suburbs, after controlling for transit connectivity.
- Population density is increasing in some older suburbs and will increase transit ridership if existing service is improved.
- The population density gradient in medium-sized metropolitan areas—those with about one million inhabitants—is becoming steeper and similar to the gradient in Canadian cities. Their inner-city neighborhoods have not deteriorated to the same degree as those in the largest, American metropolises, and they have become attractive to immigrant households who are more dependent on public transit.
- Employment density is a surrogate for land uses that attract transit users. Although both commercial and industrial land uses are continuing to disperse, commercial centers, especially the downtown (i.e., the CBD and the adjacent office buildings) continues to attract trips.

TRANSPORT POLICY FACTORS

Background

The growth and change in national travel patterns, as well as differences among individual travelers or groups of travelers, are not independent of a host of transportation and nontransportation policies. The suburbanization of employment, for example, was accelerated by both local and national policies permitting or encouraging development in undeveloped or low-density areas. The growth of both tourism and large concentrations of retirees in very rural areas has often been the result of conscious state or local economic development strategies.

Along with policies which have been in effect for several years, the four major policy trends likely to affect transit ridership in the coming decade are

- Decreasing federal transit assistance,
- Relaxation of transportation control mandates,
- Service to people with disabilities, and
- Diversion of highway funding ("flexing").

Long-Term Policies

Many federal and state policies affect the financing, operation, and competitiveness of transit. Through home mortgage guarantees, disproportionate subsidies to highways, and tax laws which have made it possible for businesses to claim deductions for the parking provided employees—but little of the cost of transit services*—the federal government has helped provide incentives for the creation of communities where transit is not a competitive option. By not requiring the auto to pay a larger share of the costs it creates—for example, by enacting policies which directly and indirectly tax driving and auto ownership to a substantial degree—and by not providing significant support to transit systems, U.S. public policy has accelerated growth in the use of the private car.

Local governments, too, have contributed to the development of low-density suburbs where it is difficult to provide meaningful transit options. By implementing zoning and building codes which require neighborhoods of single-family housing, prohibit or discourage a mixture of commercial and residential land uses, require developers to provide abundant parking but little transit access or service, and limit how many units can be built on an acre of land (ironically, often for environmental reasons), local governments have created substantial disincentives to transit use.

* In 1993 tax exempt parking subsidies were limited to $155 per month while exempt transit benefits were capped at $60 per month. Moreover, the only parking subsidies affected are direct cash payments; employers may continue to provide unlimited free parking to employees.

Current Policies

The most important governmental policy affecting public transit operators is the continued reduction in federal funding assistance. In November of 1995, federal funding of transit's overall appropriations was reduced by 12 percent to $4.1 billion. Operating assistance was reduced 44 percent, from $710 million in 1995 to $400 million in 1996. Larger transit agencies felt the reduction more deeply; those in urbanized areas with more than 200,000 lost almost 48 percent of their operating assistance while rural operators lost 17 percent of their operating assistance. Federal funding has constituted less and less of total transit operating and capital expenses for some time; in 1993, federal assistance accounted for only 4 percent of the total operating expenses of the 30 largest transit operators.

The next most important governmental initiatives likely to affect transit markets today and in the future are those requiring significant changes in transport policy and pricing to meet environmental standards. The 1990 Federal Amendments to the Clean Air Act (CAAA) contain explicit provisions about the responsibility of communities to reduce air pollution. ISTEA establishes a specific process to integrate transportation planning and air quality goals in state and sub-state regional planning processes. In particular, Section 1034 of ISTEA requires states to develop, establish, and implement a system for managing traffic congestion. The CAAA also requires states to develop state implementation plans which explain how they will come into conformity with the clean air standards.

Section 182 of the CAAA requires states with "Severe" or "Extreme" nonattainment areas to develop employee trip reduction programs, also known as employee commute options (ECOs). This policy was designed to require employers and local governments to correct or change policies which have made transit less attractive than driving alone. That is, in contrast to voluntary ridesharing and marketing programs, the act requires the active participation of employers in the travel decisions of their workers.

All employers with more than 100 workers in nonattainment areas must develop programs of transportation control measures that increase employee work trip passenger occupancy by 25 percent above the area average—which creates an ever increasing target. So employers would be forced to move increasingly from carrots (e.g., rideshare matching programs, free parking spaces for carpoolers, and free passes for transit users) to sticks (e.g., banning parking and changing work schedules [e.g., shortening workweeks—to limit the number of home-to-work trips]).

In theory, these programs should encourage the use of public transit options, but the effect of such mandates on transit use have not yet been so encouraging. Experience from the Southern California area, as well as from states and regions with similar legislation, shows that many people switch to ridesharing modes rather than public transit when faced with sanctions on driving alone. However, these kind of regulations may still be creating potential transit markets—markets that would be realized if matched to the appropriate service concepts.

Unfortunately for those looking to these regulations to increase transit markets, both the federal and state governments have stopped enforcing such measures—largely because so many workers have already made inter-linked housing, domestic, transportation, and employment choices which are not or cannot be well served or replaced by transit. As such, these measures would create substantial disruptions in people's lives.

In Illinois, implementation of the ECO program was suspended. ECO programs have also been suspended or disbanded in Pennsylvania, New Jersey, and Texas[215]. These states have adopted policies stressing voluntary compliance and incentive programs instead. Most striking, the mandatory programs of the South Coast Air Quality Management District's (SCAQMD) Section XV have been discontinued.

As of January 1, 1996, California abolished regionally and locally imposed employer trip reduction requirements; local governments are expressly forbidden to require trip reduction efforts unless they are required by federal law. In response to their remaining federal requirements, Southern California's SCAQMD approved a new rule (2202) requiring employers to chose from various options that would produce emission reductions at least equivalent to those that had been claimed from previous programs. One of the four options is for employers to pay $60 per worker into a fund that would finance emission reduction projects. Given that the San Francisco Bay area was never subject to federal trip reduction requirements, the Bay Area Air Quality Management District and several local jurisdictions in the area may have to immediately rescind their carpool and transit requirements[216].

The federal government has also reconsidered such measures. In December of 1995, the Employee Trip Reduction (ETR) requirements were repealed. Employee travel reduction programs are now optional, at the discretion of individual states. The December legislation (HR 325) even allows states to remove required ETR measures from previously submitted state implementation plans.

Ken Orski, a keen observer of the transportation scene, has noted,

> ECO's repeal, however, does not consign travel demand management to oblivion . . . Local communities [have] little choice but to continue pursuing demand-reducing strategies. Without the authority of the law behind it, however, public authorities will need to rely on incentives and persuasion rather than on regulatory commands and sanctions to influence commuters' driving habits.[217]

Transit systems may have difficulty providing incentives, given anticipated reductions in financial assistance. The FTA FY 1996 transit budget was reduced by $563 million with operating subsidies the hardest hit—down 44 percent from FY95 to $400 million. This will put increasing pressure on

transit systems to find additional local sources of funding and to cut low-productivity or high-cost services. A survey by APTA found that as many as 40 percent of the systems they surveyed may increase fares while over a third may cut service or postpone planned improvements. One in five might lay off employees because of these cuts[218].

Finally, the 1990 Americans with Disabilities Act (ADA) requires substantial obligations on transit systems. The ADA became law in July of 1990, extending to eligible people with disabilities the comprehensive civil rights conferred on racial minorities by the Civil Rights Act of 1964. Title II of the act requires transit systems to provide both fixed-route accessible transit (i.e., lifts or ramps on buses) and complementary paratransit, or special demand-responsive, services. After August of 1990, transit operators may only purchase or lease accessible vehicles. Light rail and rapid rail systems are required to have at least one accessible car per train by July 1995. Rapid rail systems must also make key stations accessible "as soon as practical" but no later than July 1993.

Section 223 of Title II mandates that transit operators providing fixed-route bus services also provide complementary paratransit services which "shadow" fixed-route operations, serving those who cannot use fixed-route buses. These services must be provided in areas ¾ mile on each side of existing fixed-route operations and 1.5 miles at the end of routes; coverage must be total within the core of the service area. The required paratransit services must be comparable—in schedule, fares, and coverage—to traditional services offered the general public. Only systems operating commuter rail and inter-city rail services or commuter or school buses are exempt (and only for those services). Systems have until January of 1997 to comply but they must be making steady progress prior to that date.

Complementary or comparable paratransit must be provided for the following classes of eligible riders:

- Those who cannot independently board, ride, or disembark from accessible vehicles;
- Those who need a lift or ramp to access a traditional bus but are not currently served by accessible buses; and
- Those who have a specific impairment-related condition which prevents them from traveling to a stop or boarding even an accessible bus (or which, in combination with environmental barriers prevent them from boarding).

Because fixed-route and paratransit services are inherently not comparable, the regulations give some operational measures of comparable paratransit service as follows:

- Paratransit users may be charged double the base transit fare—reflecting the higher service level.
- Users may be required to call for service the night before (but no earlier) and they must be given the opportunity to call on weekends.
- Users may be asked to reschedule a trip—but by no more than 1 hour.
- Users cannot be refused service if they cannot or will not reschedule to a better time for the system—this is often called the "no capacity constraint rule."
- Users cannot be asked why they are traveling or refused (or granted) service based on the purpose of their trip.
- The system cannot accept "subscriptions" (or standing reservations) for more than 50 percent of capacity in any hour, and they do not have to accept subscriptions at all.

Almost all of these service requirements conflict with the way in which most communities provided pre-ADA paratransit. So meeting these requirements can require a significant expenditure of funds. In 1993, the FTA estimated that annual costs of only the mandated paratransit services would be about $700 million per year (in 1993 dollars)—the bulk being operating costs. A recent study reported that U.S. systems were spending $100 million per year on paratransit equipment and roughly $700,000 million per year on paratransit operating expenses—all coming from existing transit budgets. As a result the average paratransit trip cost approximately $15 in 1995 dollars[219]—up almost 50 percent from 1989 to 1990[220].

Impact of Transport Policy Trends on Current and Future Transit Markets

At this time (1996), changes to federal, state, and local government policies are not anticipated. In the absence of policy changes, the effects of current policies on transit are likely to continue. However, that ISTEA permits the diversion of highway funds to projects supporting transit may help—several cities are planning to use these funds to build joint developments, park-and-ride facilities, and childcare centers at transit stations.

SUMMARY

Travel Patterns Created by Societal Trends

Most of the trends described above will have sometimes profound affects on both home-to-work commutes and non-work travel. Overall they will lead to a substantial increase in the total number of trips and the total number of miles traveled by all Americans. Some of the aggregate changes will be a response to growth in the number of travelers. However much of the aggregate growth in travel will reflect sometimes remarkable changes in the patterns of individual travelers—changes also created by the same combination of societal trends.

Overall, the societal trends just reviewed will affect the characteristics of individual trips by

- Increasing the per capita number of trips,
- Increasing the number of non-work trips relative to work trips,

- Increasing the length of both work and non-work trips,
- Increasing the variability of trip scheduling,
- Increasing the number of linked trips or trip-chaining, and
- Increasing the number of trips made outside the "traditional" peak periods.

These trends will also affect the origins and destinations of individual trips by

- Increasing the number of suburb-to-suburb trips,
- Increasing the number of suburban or central city trips to rural areas,
- Decreasing the relative importance of central city destinations, and
- Increasing the number of central city to suburb trips.

Many of these changes in individual trip patterns work to the detriment of public transit. Transit is best at serving large groups of travelers going to one or a few destinations along concentrated corridors of demand in concentrated peaks—most of the changes described above reduce the net number of such travelers. Longer trips incur more severe time penalties using transit; suburban densities are not generally as well served by transit as are more central destinations. Although the number of people dependent on transit may also increase as the population increases, the percentage of each group using transit will generally decline because of such trends.

At the same time, current transit ridership accounts for such a small portion of current U.S. travel that even a tiny diversion from driving alone would translate into a substantial increase in transit ridership in most service environments. Many of the trends just reviewed may increase transit ridership in the short term simply because groups more likely to use transit are growing and give transit operators the opportunity to increase ridership by doing niche marketing and by taking advantage of land use changes which have made transit more attractive in some areas or to some riders.

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APPENDIX D

SECTION 15 ANALYSIS

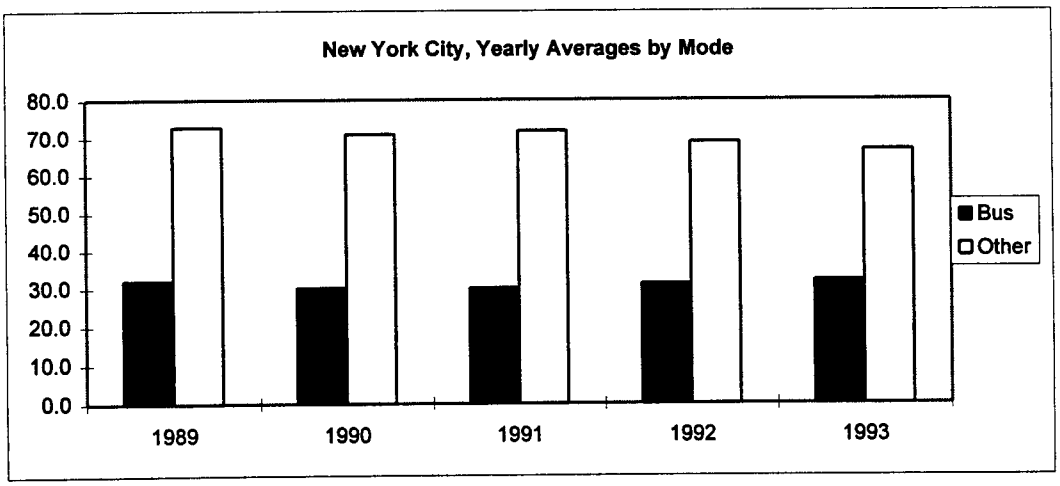
AVERAGE PASSENGERS PER REVENUE VEHICLE HOUR OF OPERATORS IN NEW YORK CITY

5 Year Average Annual PRVH

Agency (reporting in 1992 and 1993)	Motor Bus	Trolley Bus	Heavy Rail/ Rapid Rail	Light Rail Street Car	Commuter Rail	Other
Port Authority-PATH			96.3			
NY-MTA-NYCTA	59.4		91.5			
New Jersey Transit	30.4			79.06	43.2	
NY-MTA-Metro North RR					58.9	
NY-MTA-Long Island RR					53.3	
NY-Westchester-Liberty(91-93)	47.2					
NYCDOT-Green Bus (91-93)	46.3					
NY-MTA-Long Island Bus	43.7					
NYCDOT-Triboro(91-93)	42.1					
NYCDOT-Queens (90,92-93)	41.1					
NJ Transit (Contract) (91-92)	35.3					
NJ-NJTC/Academy (91-93)	18.0					
NYCDOT-Bus Tours (91-93)	14.9					
NYCDOT-Command Bus(91-93)	14.7					
NJ-NJTC/Suburban (91-93)	14.1					
NJ-NJTC/Hudson Transit (91-93)	8.9					

Average Annual PRVH by Mode

Year	Bus	Other
1989	32.1	73.1
1990	30.1	71.1
1991	30.1	72.1
1992	31.2	69.0
1993	31.9	66.8



AVERAGE PASSENGERS PER REVENUE VEHICLE HOUR OF OPERATORS IN CHICAGO

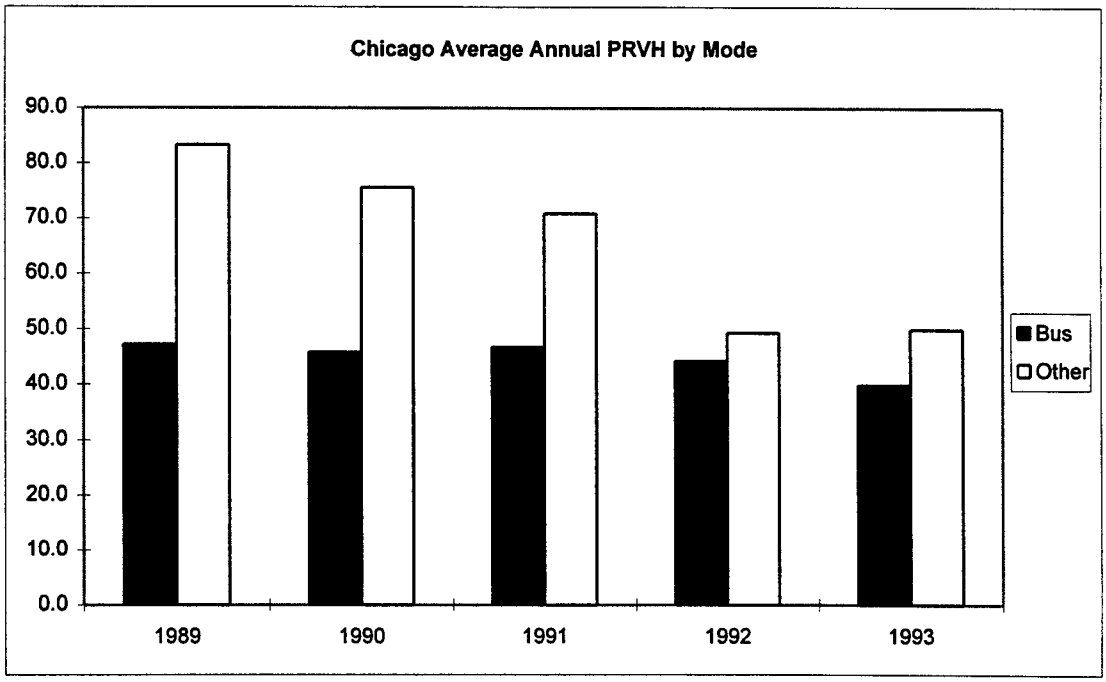
5 Year Average Annual PRVH

Agency (reporting in 1992 and 1993)	Motor Bus	Trolley Bus	Heavy Rail / Rapid Rail	Light Rail/ Street Car	Commuter Rail	Other
Chicago-Metra/BN RR					98.9	
Chicago-RTA-Metra					70.5	
Chicago-RTA-CTA	54.5	65.6				
Chicago-Metra/C&NW RR (91-93)					62.2	
Chicago-RTA-Pace*	37.7					8.3

* Other: VP, 1992 -1993 only

Average Annual PRVH by Mode

Year	Bus	count	Other	count
1989	47.3	3	83.4	4
1990	45.7	3	75.6	4
1991	46.8	2	70.9	4
1992	44.2	2	49.3	6
1993	39.8	3	50.0	6



AVERAGE PASSENGER PER REVENUE VEHICLE HOUR OF OPERATORS IN HIGH DENSITY CITIES WITH POPULATION GREATER THAN 1 MILLION (WITH RAIL)

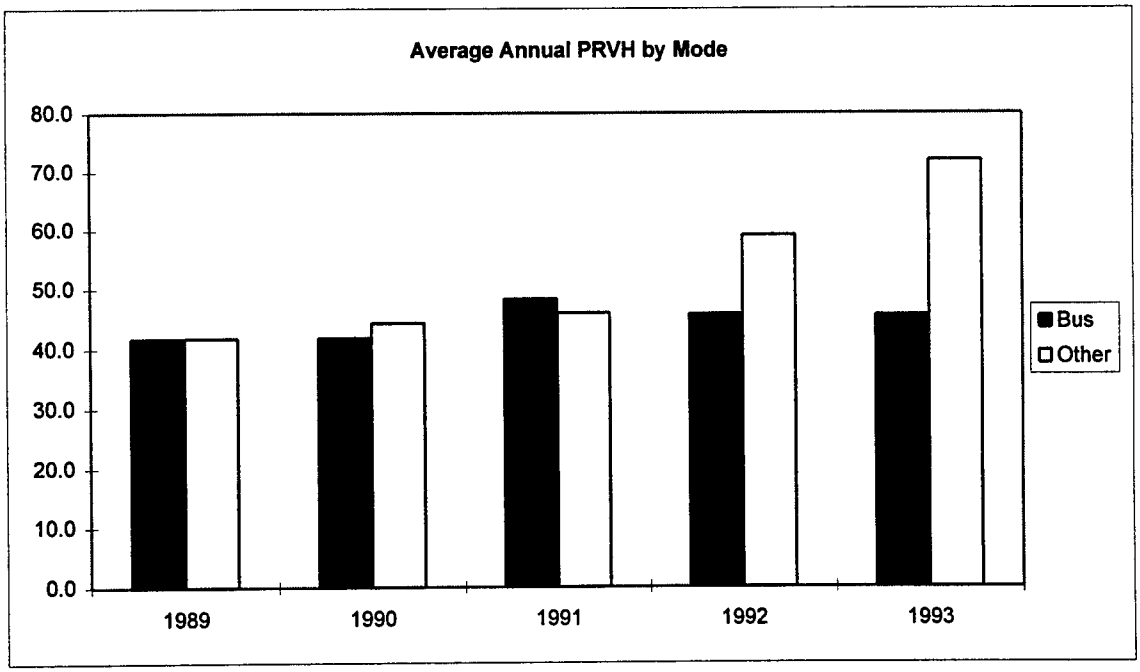
5 Year Average Annual PRVH

Agency (reporting in 1992 and 1993)	Motor Bus	Trolley Bus	Heavy Rail/ Rapid Rail	Light Rail/ Street Car	Commuter Rail	Other
LA-LACMTA/SCRTD* (91-93)			113.5	67.2		
Miami-MDTA	35.1		75.9			87.4
LA-Santa Monica	66.1					
LA-LACMTA/SCRTD	58.1					
LA-Long Beach Transit	40.8					
LA-OCTA	34.4					6.8

* LR: 91-93 only, HR: 93 only

Average Annual PRVH by Mode

Year	Bus	count	Other	count
1989	41.8	6	41.8	4
1990	41.9	6	44.3	4
1991	48.3	5	45.9	5
1992	45.7	5	59.1	4
1993	45.5	5	72.0	5



AVERAGE PASSENGERS PER REVENUE VEHICLE HOUR OF OPERATORS IN MEDIUM DENSITY CITIES WITH POPULATION GREATER THAN 1 MILLION (WITH RAIL)

5 Year Average Annual PRVH

Agency (reporting in 1992 and 1993)	Motor Bus	Trolley Bus	Heavy Rail/ Rapid Rail	Light Rail/ Street Car	Commuter Rail	Other
Boston-MBTA	47.0	56.4	155.5	241.6	40.4	
Washington-WMATA	50.7		127.8			
SF-Golden Gate 1	22.1					135.2
San Francisco-Muni2	71.7	86.7		103.8		78.6
Philadelphia-SEPTA	51.7	77.4	101.5	92.3	54.4	
Baltimore-Maryland-MTA3	51.7		87.9	33.9		1.8
Portland-Tri-Met	37.9			82.4		
New Orleans-RTA4	57.4			81.9		1.6
Sacramento-RT	31.3			80.9		
San Francisco BART			59.4			
San Jose-SCCTD	31.1			50.9		
Maryland-Ride-On	41.4					4.0
San Diego Transit	37.0					
Oakland-AC-Transit	36.1					
SF-SamTrans	31.2					
San Diego-NCTD	23.7					

1-Other=FerryBoat

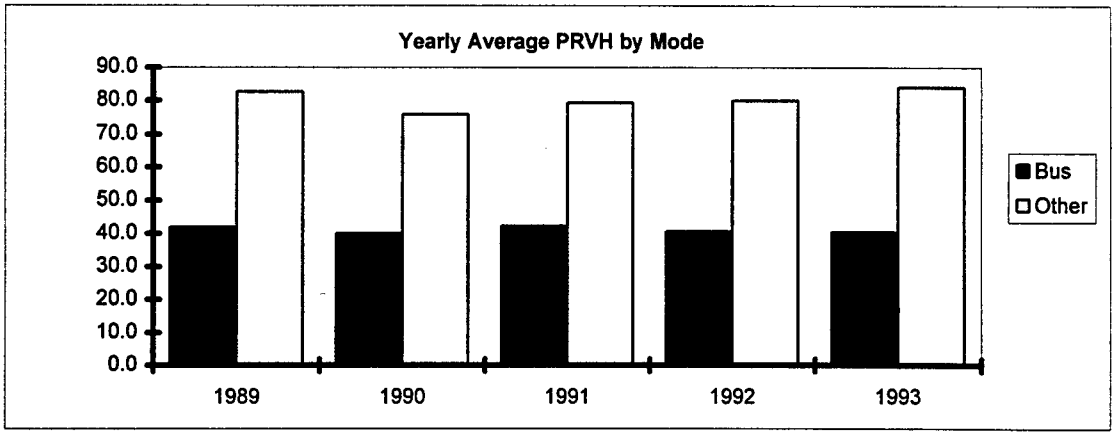
2-Other=CableCar

3-LR: 92-93 only

4-Other=DR, 1992 only

Average Annual PRVH by Mode

Year	Bus	Other
1989	42.0	82.7
1990	40.0	75.9
1991	42.2	79.4
1992	40.6	79.9
1993	40.4	84.0



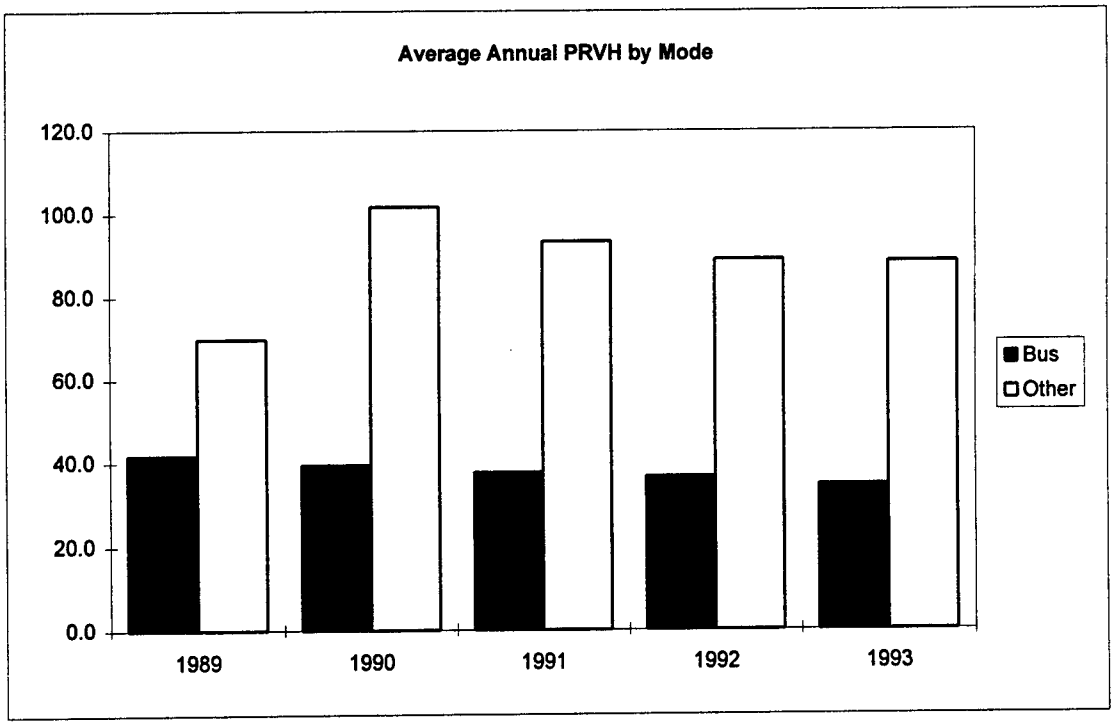
AVERAGE PASSENGERS PER REVENUE VEHICLE HOUR OF OPERATORS IN LOW DENSITY CITIES WITH POPULATION GREATER THAN 1 MILLION (WITH RAIL)

5 Year Average Annual PRVH

Agency (reporting in 1992 and 1993)	Motor Bus	Trolley Bus	Heavy Rail/ Rapid Rail	Light Rail/ Street Car	Commuter Rail	Other
Pittsburgh-PAT	36.56			66.44		161.44
Atlanta-MARTA	39.4		104.24			
Cleveland-RTA	38.16		89.58	105.16		3.58

Average Annual PRVH by Mode

Year	Bus	count	Other	count
1989	41.7	3	69.7	6
1990	39.4	3	101.7	6
1991	37.7	3	93.3	6
1992	36.6	3	88.9	6
1993	34.7	3	88.4	6



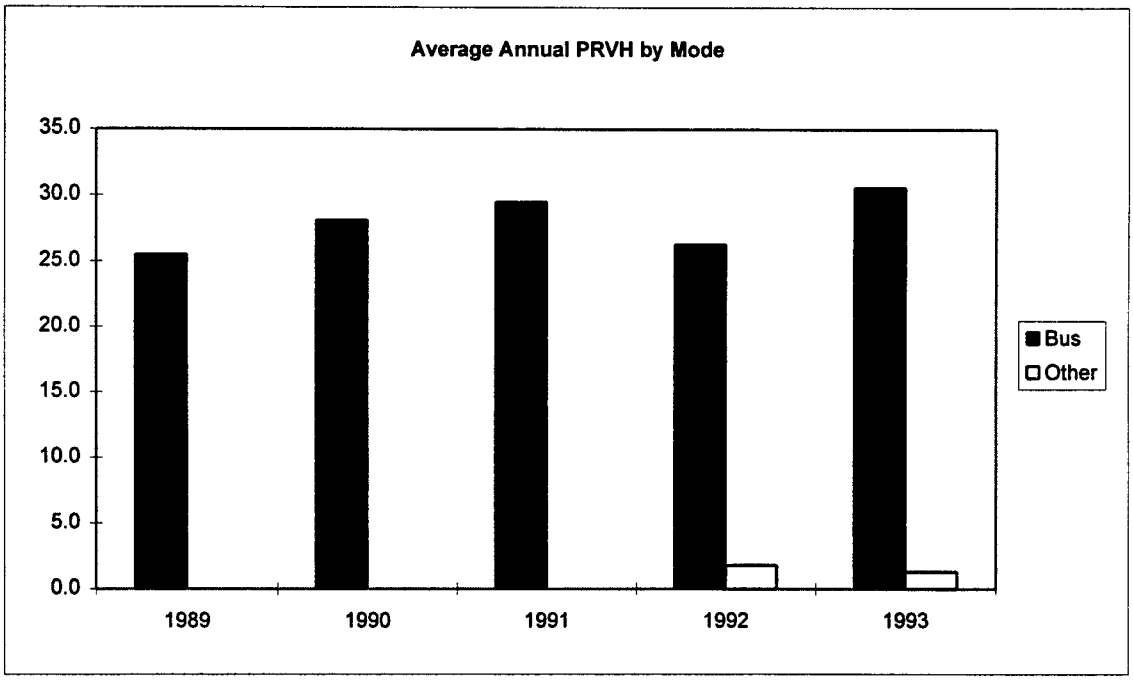
AVERAGE PASSENGERS PER REVENUE VEHICLE HOUR OF OPERATORS IN HIGH DENSITY CITIES WITH POPULATION GREATER THAN 1 MILLION (WITHOUT RAIL)

5 Year Average Annual PRVH

Agency	Motor Bus	Trolley Bus	Heavy Rail/	Light Rail/	Commuter	Other
(Reporting in 1992 AND 1993)			Rapid Rail	Street Car	Rail	
San Juan-MBA	28.0					1.55

Average Annual PRVH by Mode

Year	Bus	count	Other	count
1989	25.5	1		1
1990	28.1	1		1
1991	29.5	1		1
1992	26.3	1	1.8	1
1993	30.6	1	1.3	1



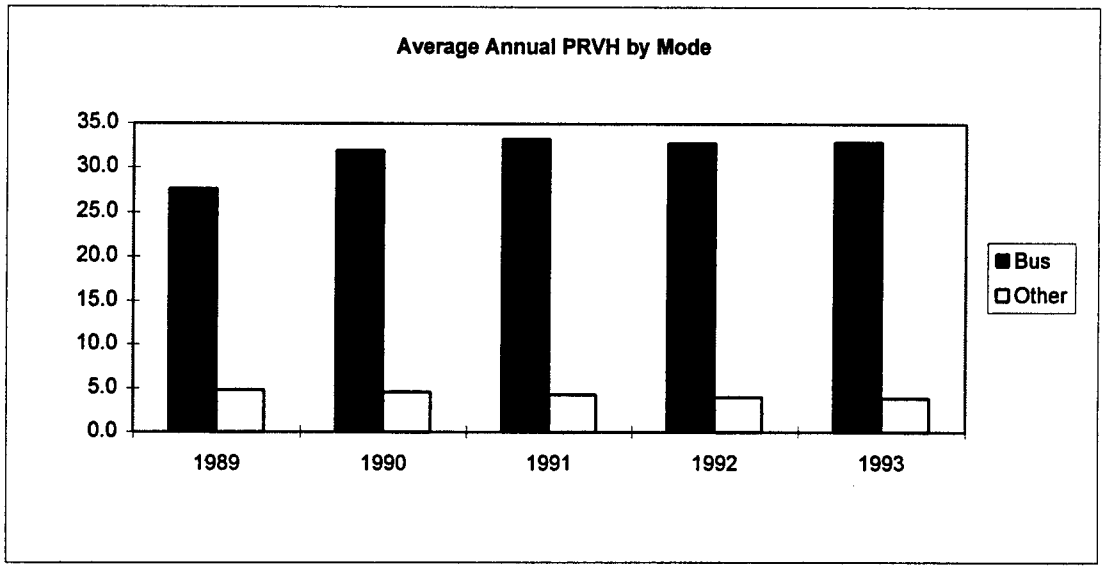
AVERAGE PASSENGERS PER REVENUE VEHICLE HOUR OF OPERATORS IN MEDIUM DENSITY CITIES WITH POPULATION GREATER THAN 1 MILLION (WITHOUT RAIL)

5 Year Average Annual PRVH

Agency (reporting in 1992 and 1993)	Motor Bus	Trolley Bus	Heavy Rail/ Rapid Rail	Light Rail/ Street Car	Commuter Rail	Other
Ft. Lauderdale-Bct	28.2					
Detroit-SMART	22.0					4.3
Detroit-D-DOT	44.8					

Average Annual PRVH by Mode

Year	Bus	count	Other	count
1989	27.6	3	4.8	3
1990	31.9	3	4.6	3
1991	33.2	3	4.3	3
1992	32.8	3	4.0	3
1993	32.9	3	3.9	3



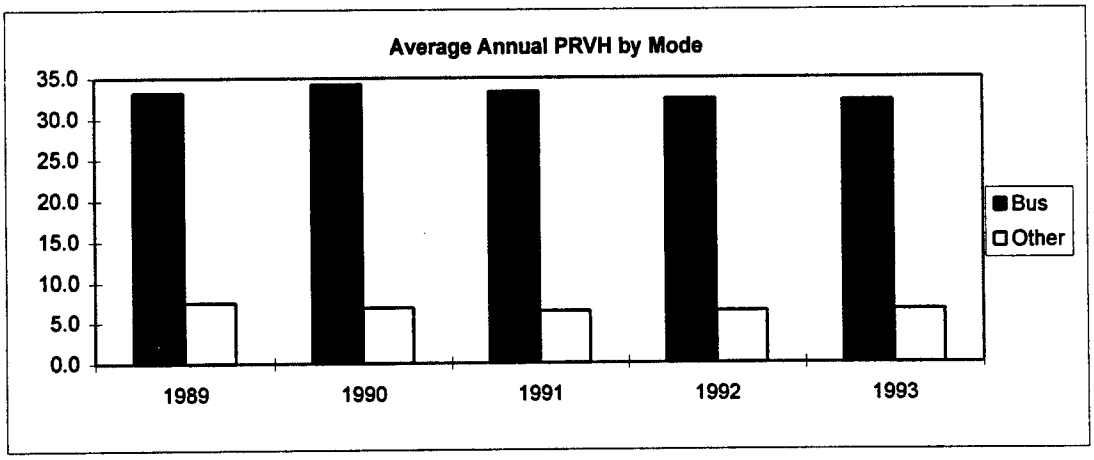
AVERAGE PASSENGERS PER REVENUE VEHICLE HOUR OF OPERATORS IN LOW DENSITY CITIES WITH POPULATION GREATER THAN 1 MILLION (WITHOUT RAIL)

5 Year Average Annual PRVH

Agency (reporting in 1992 and 1993)	Motor Bus	Trolley Bus	Heavy Rail/ Rapid Rail	Light Rail/ Street Car	Commuter Rail	Other
Seattle-Metro	38.8	64.0		20.0		11.8
Minneapolis-St. Paul-MTC	43.1					
Phoenix-Phoenix TS/ATC (91-93)	43.0					
Denver-RTD (Other: DR, 90-93)	41.9					16.2
Milwaukee-County	41.9					
Houston-Metro	38.3					
Cincinnati-SORTA	37.3					
Dallas-DART	37.2					
St. Louis-Bi-State	34.8					3.0
San Antonio-VIA	33.8					2.0
Kansas City-KCATA (Other: DR, 93)	30.6					5.0
Newport News-Pentran	25.4					3.7
St. Petersburg-PSTA	23.4					2.4
San Bernardino-OMNITRANS	22.1					
Tampa-Hartline	22.0					
Norfolk-TRT (Other: VP only, no DR)	19.5					11.0
Dallas-DART/ATE (91-93)	18.5					
Fort Worth-The T	15.7					2.3

Average Annual PRVH by Mode

Year	Bus	count	Other
1989	33.2	19	7.5
1990	34.2	19	6.9
1991	33.3	19	6.4
1992	32.5	19	6.4
1993	32.3	18	6.6



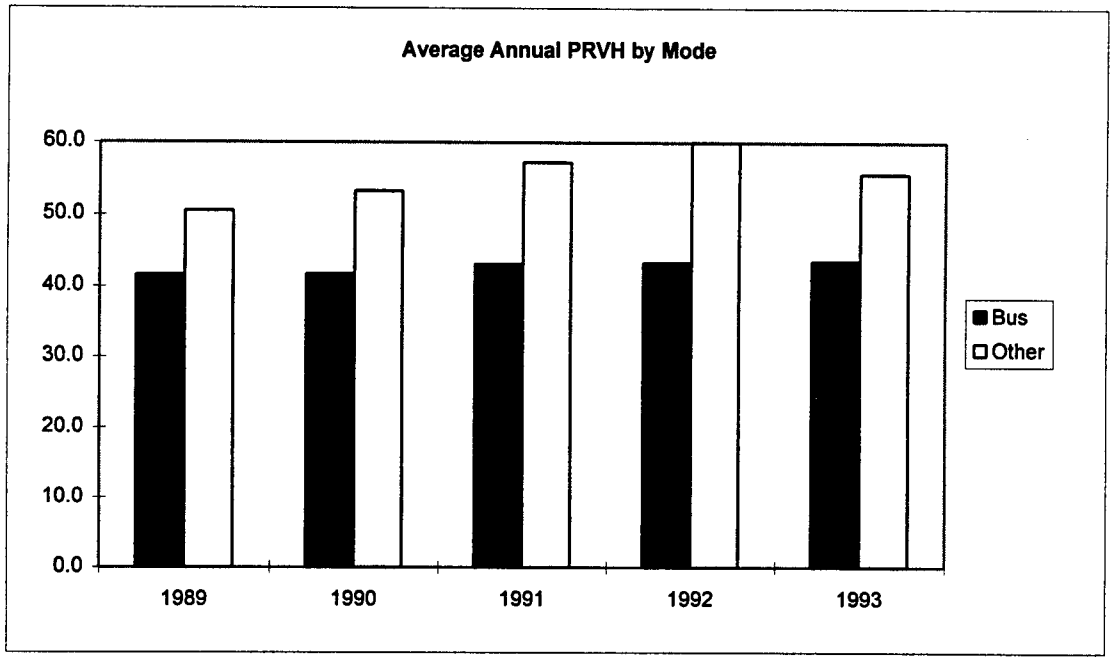
AVERAGE PASSENGERS PER REVENUE VEHICLE HOUR OF OPERATORS IN MEDIUM DENSITY CITIES WITH POPULATION 500,000 - 1 MILLION

5 Year Average Annual PRVH

Agency (reporting in 1992 and 1993)	Motor Bus	Trolley Bus	Heavy Rail / Rapid Rail	Light Rail/ Street Car	Commuter Rail	Other
Buffalo-NFTA	29.16			107.8		
Honolulu-DTS	67.48					
Salt Lake City-UTA	31.56					2.92

Average Annual PRVH by Mode

Year	Bus	count	Other	count
1989	41.7	3	50.6	2
1990	41.8	3	53.3	2
1991	43.2	3	57.3	2
1992	43.4	3	60.0	2
1993	43.6	3	55.7	2



AVERAGE PASSENGERS PER REVENUE VEHICLE HOUR OF OPERATORS IN LOW DENSITY CITIES WITH POPULATION 500,000 - 1 MILLION

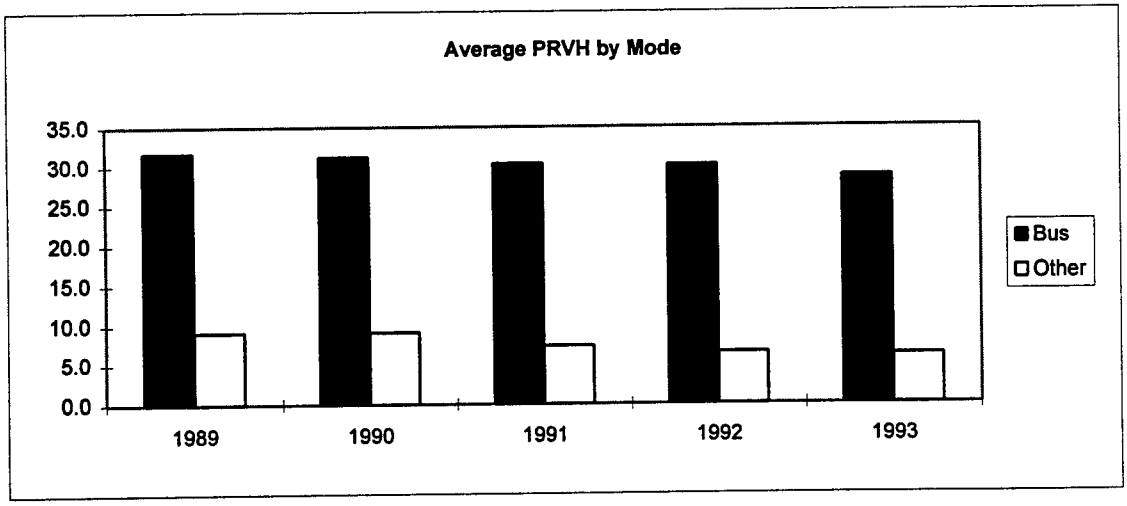
5 Year Average Annual PRVH

Agency (reporting in 1992 and 1993)	Motor Bus	Trolley Bus	Heavy Rail Rapid Rail	Light Rail/ Street Car	Commuter Rail	Other
Jacksonville-JTA	21.2					68.9
Richmond-GRTC	51.4					
Hartford-CT Transit	41.4					
Louisville-TARC	39.3					5.5
El Paso-Sun Metro	38.6					
Austin-Capital Metro	37.5					2.7
Tucson-Sun Tran	36.8					2.0
Providence-RIPTA	34.4					
Rochester-RTS	33.0					3.4
Indianapolis-Metro	32.2					
Memphis-MATA	32.0					4.1
Dayton-RTA	23.6	29.7			3.9	
Columbus-COTA	29.3					
Nashville-MTA	28.3					7.4
Albany-CDTA	25.8					2.1
Birmingham-Max	24.5					
Orlando-LYNX	24.4					
Tacoma-Pierce Transit*	23.9					3.5
Akron-Metro	22.7					5.3
Omaha-TA	20.0					2.1
Oklahoma City-COTPA	19.5					1.3
Nashville-MTA (92-93)						19.4
Birmingham-Max (91-93)						9.7
El Paso-Sun Metro (89,90,93)						2.6
Indianapolis-Metro(89-92)						1.8

* Also VP, 13.8

Average Annual PRVH by Mode

Year	Bus	count	Other	count
1989	31.7	22	9.2	16
1990	31.2	22	9.1	17
1991	30.4	22	7.3	17
1992	30.1	22	6.5	18
1993	28.7	22	6.2	19



AVERAGE PASSENGERS PER REVENUE VEHICLE HOUR OF OPERATORS IN LOW DENSITY CITIES WITH POPULATION 200,000 - 500,000

5 Year Average Annual PRVH

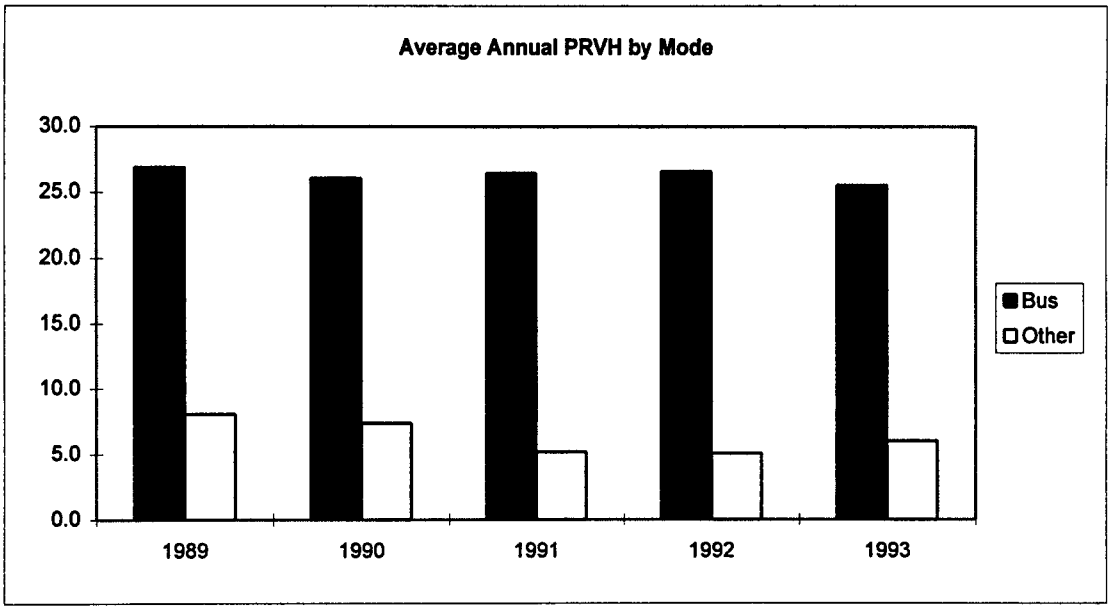
Agency (reporting in 1992 and 1993)	Motor Bus	Trolley Bus	Heavy Rail Rapid Rail	Light Rail/ Street Car	Commuter Rail	Other
Syracuse-RTA-Centro	37.9					3.2
Charlotte-CTS**	35.2					14.5
Madison-MMT	30.9					2.8
Worcester-WRTA	28.1					3.7
Spokane-STA*	20.8					11.4
Toledo-TARTA	19.1					
Metropolitan Tulsa TA (89,90,93)	18.0					15.6
Albuquerque-Sun Tran (Other: DR,	17.8					1.5

*DR = 3.4

** DR = 2.58

Average Annual PRVH by Mode

Year	Bus	count	Other	count
1989	26.9	9	8.0	8
1990	26.0	9	7.4	8
1991	26.4	7	5.2	8
1992	26.6	7	5.1	8
1993	25.5	9	6.0	9



PRODUCTIVITY ANALYSIS FOR SELECTED CITIES, 1993 SECTION 15 DATA

	Bus	Bus	Bus	Heavy/ RapRail	Heavy/ RapRail	Heavy/ RapRail	Lt Rail StrCar	Lt Rail StrCar	Lt Rail StrCar	Cmtr Rail	Cmtr Rail	Cmtr Rail
	Cost/ Pass Trip	Cost/ Pass Mile	Pass/ RVH	Cost/ Pass Trip	Cost/ Pass Mile	Pass/ RVH	Cost/ Pass Trip	Cost/ Pass Mile	Pass/ RVH	Cost/ Pass Trip	Cost/ Pass Mile	Pass/ RVH
New York												
PATH				2.51	0.57	97.05						
NY-MTA-NYCTA	1.60	0.79	55.95	1.81	0.38	72.70						
N.J. Transit	3.04	0.50	27.35				1.60	0.52	71.64	7.30	0.33	44.37
NY-MTA-Metro North RR										7.29	0.31	59.55
NY-MTA-Long Island RR										6.72	0.32	55.61
NYCDOT-Green Bus	1.59	0.65	50.18									
NY-MTA-Long Island Bus												
NYCDOT-Triboro	2.21	0.86	39.18									
NYCDOT-Queens	2.35	0.63	49.56									
NJ Transit (Contract)	1.44	0.25	36.55									
NJ-NJTC/Academy	5.04	0.10	16.98									
NYCDOT-Bus Tours	5.52	0.31	16.84									
NYCDOT-Command Bus	6.54	0.59	14.56									
NJ-NJTC/Suburban	5.18	0.13	14.16									
NJ-NJTC/Hudson Transit	8.95	0.16	8.09									
**Westchester-DOT	1.51	0.28	48.70									
Chicago												
Chicago-Metra/BN RR										2.82	0.14	92.2
Chicago-RTA-Metra										5.77	0.28	64.13
Chicago-RTA-CTA	1.45	0.57	48.61	2.09	0.34	67.99						
Chicago-Metra/C&NW RR										4.06	0.18	61.51
Chicago-RTA-Pace	2.13	0.40	31.98									
Mrkt Grp 54 w/rail (den >5000, pop >1 mil)												
LA-LACMTA/SCRTD (91-	1.58	0.41	55.95	4.66	2.94	113.51	3.70	0.41	79.79			
Miami-MDTA	1.83	0.49	31.47	2.88	0.36	84.02	3.26	3.03	72.10			
LA-LACMTA/SCRTD												
LA-Long Beach Transit	1.36	0.49	39.90									
LA-OCTA	2.21	0.50	32.19							13.42	0.25	57.06
**LA-Santa Monica Big Bl	0.83	0.24	63.21									
Mrkt Grp 53 w/rail (den 3000-5000, pop > 1 mil)												
**Boston-MBTA	2.08	0.77	38.74	1.35	0.44	162.39	0.98	0.7	278.68	4.93	0.26	40.5
Washington-WMATA	1.80	0.56	48.62	1.64	0.34	131.17						
SF-Golden Gate T	4.19	0.27	21.93									
SF Muni2	1.18	0.55	69.93				1.60	0.59	105.84			
Philadelphia-SEPTA	1.72	0.65	49.17	1.16	0.26	128.76	1.01	0.43	122.75	7.35	0.51	45.94
Baltimore-Maryland-MTA3	1.48	0.42	49.02	2.85	0.53	80.20	3.60	0.51	45.51	6.78	0.23	42.82
Portland-Tri-Met	1.84	0.54	34.61				1.50	0.27	77.45			
New Orleans-RA4	1.26	0.42	63.27				0.86	0.37	73.76			
**Sacramento-RT	2.43	0.61	30.24				2.37	0.49	81.52			
SF Bart	2.87	0.28	18.23	2.60	0.22	65.83						
San Jose-SCCTD	2.94	0.75	35.03				3.14	0.46	51.77			
Maryland-Ride-On	1.88	0.57	39.10									
San Diego Transit	1.55	0.38	35.32									
Oakland-AC Transit	2.12	0.59	32.93									
SF-SamTrans	2.33	0.38	31.08									
San Diego-NCTD	2.36	0.35	21.72									
Mrkt Grp 52 w/rail (den 1000-3000, pop > 1 mil)												
**Pittsburgh-PAT	2.19	0.45	35.11				3.11	0.68	65.11			
Atlanta-Marta	1.53	0.50	36.98	1.01	0.19	94.45						
Cleveland-RTA	2.78	0.76	32.14	3.03	0.40	89.37	2.63	0.41	93.87			
Mrkt Grp 54 w/out rail (den> 5000, pop > 1 mil)												
San Juan-MBA	1.68	0.45	35.94									
Mrkt Grp 53 w/out rail (den 3000-5000, pop > 1 mil)												
**FL Lauderdale-Bct	1.76	0.40	32.45									
Detroit-SMART	4.19	0.52	17.87									
Detroit-D-DOT	1.62	0.43	45.20									
Mrkt Grp 52 w/out rail (den 1000-3000, pop > 1 mil)												
**Seattle-Metro	3.07	0.47	36.26									
Minneapolis-St.Paul-MTC	1.81	0.42	40.72									
**Phoenix-Phoenix TS/AT	1.42	0.35	43.41									
Denver-RD (other)	2.06	0.53	38.17									
Milwaukee-County	1.48	0.53	37.14									
Houston-Metro	2.01	0.36	36.43									
Cincinnati-SORTA	1.80	0.37	33.70									
Dallas-DART	2.19	0.62	37.36									
St. Louis-Bi-State	2.12	0.50	31.28									
San Antonio-VIA	1.19	0.35	33.43									
Kansas City-KCATA (othe	2.37	0.51	28.75									
Newport News-Pentran	1.43	0.28	25.04									
St. Petersburg-PSTA	2.59	0.53	19.80									
San Bernardino-OMNITR	2.48	0.34	20.58									
Tampa-Hartline	2.19	0.50	26.59									
**Norfolk-TRT (other)	2.50	0.61	17.60									
Dallas-DART/ATE	2.74	0.31	19.65									
Fort Worth-The T	3.59	0.52	13.13									

APPENDIX E
CASE STUDIES

Agency: **AUSTIN-CAPITAL METROPOLITAN TRANSPORTATION AUTHORITY**
(Capital Metro)
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NEW SERVICE CONCEPTS	TARGET MARKETS/ USER GROUPS
• Free Fare Program	Non-Riders, Potential Transit Users
• FLYERS (Limited stop routes)	Suburb to CBD
• Multi-use Transfer	Riders who typically use "Chaining of Trips"
• Partnership with University of Texas	University Students and Faculty
• Reduced Price Weekend Fare	Families

REASONS FOR HIGH PRODUCTIVITY

- Change in Transfer Policy
- Expansion of Service to University population
- Successful promotion of family weekend transit use
- Growth of Ride Finders Program

SYSTEM PROFILE

The Capital Metropolitan Transportation Authority (Capital Metro) initiated service in 1985 with an extensive system of routes. Ridership response was slow. Routes were developed using a radial system into the CBD. Travel to the CBD is still the most successful service that Capital Metro provides. In recent years, Capital Metro has experienced a 3 percent growth in ridership and productivity, with most success attributed to the provision of services to university students, special events riders, and riders with trips to downtown as their destination. Growth in ridership comes from the increase in trips to the CBD and reverse commutes from the CBD to the suburbs.

RIDER PROFILE (US Census Data 1990)

• 3.41 percent	Total Transit Use
• 43.23 percent	Female
• 22 percent	Immigrants
• 27 percent	Black
• 24 percent	Hispanic
• 74 percent	Single

SERVICE CHANGES THAT AFFECT PRODUCTIVITY

- All Potential User Groups

  During the last 3 months of 1989, the Board of Directors of Capital Metro initiated a free fare program as a demonstration project. The program was not designed to target specific riders or markets, but to increase utilization of the vehicles already in service. Capital Metro was created in 1985 with lots of service, but ridership response was slow, and buses were empty. This program was an attempt to overcome public criticism and to "fill the buses." Because of the initial success of the project, it was extended through 1990. Ridership increased from 70,000 daily boardings to a high of 130,000, a much greater increase than anticipated.

  Capital Metro estimates that changing the fare policy resulted in retention of about 6 percent of this additional market. Instead of returning to the original fare policy at the end of the program, the price of discount passes was cut in half, and cash fares returned to $0.50. It is assumed that the increase in new ridership was minimal and that the greatest increase came from existing riders who used the system more frequently during the demonstration period. The cost estimate for the project is $1 million.
- Single Parents

  A year and a half ago, Capital Metro changed its transfer policy to allow riders to use a transfer to reboard and continue travel on the same route. This change was in response to an increase in "chaining of trips," where riders left the bus to drop off children at day care, go gro-

cery shopping, or pick up dry-cleaning before reaching their destination. Capital Metro felt that permitting reboarding would improve service for these riders. Time for reboarding was increased to 3 hours on weekdays and 4 hours on weekends. Transfers are free if requested at the time the fare is paid. There has been no attempt to quantify the effect of the new transfer policy, but 2 years ago there was no growth in ridership despite a 3 to 4 percent increase in population. Following the change in transfer policy, there has been a 3 percent growth in ridership.

- Commuters
  1. Service expansion is focused on the development of new routes, called FLYERS, which provide limited stop service between the suburbs, the CBD, state offices, and the university.
  2. Capital Metro is beginning to implement a development strategy that will focus on major corridors. Specific corridors will be identified on a policy basis (not justified by current ridership) in preparation for the introduction of light rail. By promoting the use of "transit-friendly amenities" such as passenger shelters and headways in the 10- to 15-min range, growth of these corridors will be encouraged.

     As part of this strategy, Capital Metro is working with land use planners to facilitate the approval of higher density apartments along the pre-determined corridors. They are also in the early stages of a pilot project to develop "traffic signal preemptions." The development of these corridors is seen as a way to ensure equitable delivery of service. The bond issue for light rail will go to the voters early next year. Light rail service will be under the same umbrella as Capital Metro so there will not be a problem with competition. Bus routes will be restructured to provide feeder service for light rail.
  3. Capital Metro works with major employers to match workers to carpool or vanpool service. The cost is $10 a month to participants, with the driver of the vanpool riding for free. Currently, there are 121 vanpools operating as part of the voluntary trip reduction program. In 1995, the estimate is 395,000 vanpool trips; there is no mechanism for comparable tracking of carpool riders.

     This vanpool program has the highest usage in Texas, including Houston. Vans are being added to the program at the rate of 30 to 40 per year. With 25 percent growth anticipated in the program each year, Capital Metro expects to have 400 in service within 5 years.
- University Students

  Capital Metro has developed a partnership with the University of Texas to operate special shuttles from student housing areas to campus as well as provide campus circulator shuttles. Management attributes part of their increase in ridership to the successful tapping of the university population. The UPASS Program at the University of Washington in Seattle serves as a model for the University of Texas program. This program uses a combination of vanpooling, Capital Metro shuttles, taxis for "guaranteed rides home"—whatever works best for this rider population.

  The cost of the pass is covered by student activity fees. To encourage use by faculty and staff, the university subsidizes the pass from the revenue resulting from increased parking fees. The university already uses smart cards for library services. Fare boxes could be equipped with card readers allowing for debit usage. The University of Washington has as a component of its program surplus parking set aside for pass holders that need to drive their cars on an occasional basis, such as a doctors appointment. Regular vanpool riders can use their pass for a day of parking service 3 days a month.
- Families

  In January 1994, Capital Metro began a program designed to target families and promote weekend ridership. The weekend fare was reduced to $0.25 and included a transfer slip valid for the entire day. The program which ran for 6 months was very successful in attracting new riders. Ridership continued after return to regular fare.
- Special Events

  Capital Metro provides shuttle service for many special activities in the Austin area. Shuttles typically run from close-in shopping malls, park-and-ride lots, and high school and state parking lots. Most events are near the waterfront, and passengers are charged $1 round trip fare. Service is provided to community events, such as the Aqua Fest, 4th of July Fireworks, and University of Texas football games. During the Christmas season, there are Light Tours in replica trolleys. Management estimates that special events service costs about $250,000 annually. Their policy states that if 25 percent of the expenses are not recovered for a particular event, service for that event would be discontinued. There is no monitoring of this service to estimate the effect on new ridership, it is used primarily as a marketing tool.

MONITORING PRACTICES

Capital Metro uses market research to define markets, identify potential riders, and plan deployment of new service. The agency examines what types of inducements the potential rider pool needs to make mass transit a viable option. Origin and destination data, as well as detailed information on places and markets, are loaded into a geographical information system and analyzed. On-board studies are conducted every 3 years with pulse type studies in between. Capital Metro uses focus groups to look at all their services (e.g., public information dissemination, pass programs, pre-payment programs, and distribution sites). On-board surveys are

used to modify service, generally for more qualitative than quantitative changes.

FARE STRUCTURE AND PASS PROGRAM

Cash-paying riders account for 50 percent of all trips. Twenty-five percent use passes and 25 percent use transfers. The UPASS for University of Texas students is paid as a flat fee out of the student activity fund. A sticker is placed on student ID cards which are then valid as passes on any type of transit service at no extra charge. There is a also a Metro Pass which can be used for all local transit services, including premium services, such as door-to-door service, paratransit service in some zones, and some FLYER routes. The advantage of this pass is the provision of premium services at the Metro rate of $10 a month for adults and $5 for public school students.

There is a separate Express Park and Ride Pass which costs $17 a month with students riding at half fare. There are also discounted ticket booklets used by social service agencies for their clients. The overall strategy is to minimize the use of cash fare and maximize the use of pre-paid passes. Reduction in the use of cash fares leads to a reduction in boarding time and improved service delivery. As part of the move away from cash transactions, the use of Smart Cards to reduce dwell time has been proposed. This would lead to a reduction in run time, a reduction in costs, and increased efficiency.

ROUTE-SPECIFIC INFORMATION AS AN INDICATOR OF GROWTH TRENDS

1. The #62 Quail Valley Corridor serves the growing north-central area of the city and provides feeder service to a FLYER limited stop route. It is in a high growth area, with several industrial sites which attract reverse-commute riders, a community college that has a growing student body because of enrollment caps at the university, and residential service for a minority population that has experienced higher than average disbursement during the 1980s and migrated to the north-central part of the city.
2. A new cross-town route introduced 3 years ago travels through large population centers, with a high concentration of student housing, and high technology employment sites. The middle of the route is characterized by low-income projects, with a major grocery store and retail strip, and a high school. The other end of the route is mixed residential, with multiple origins and destinations. Usually cross-town routes are not strong growth routes. This one has higher growth than expected.
3. The toughest market to provide service for, and consequently the least successful, has been the suburb-to-suburb service. Capital Metro is trying to deal with this market through the vanpooling and teleride programs. Also the CBD-to-suburb reverse-commute routes have been unsuccessful. Capital Metro is working on plans to improve this service. Non-CBD trips within the city limits need improvement. Because the system operates on a radial orientation, travel within the city without travel into the CBD is limited.

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Director of Planning

NEW SERVICE CONCEPTS	TARGET MARKETS/ USER GROUPS
• New Transit Superstations	Commuters
• New Commuter Rail Lines	Commuters
• Cross-Town Bus Routes	Students, Patients, and Employees at Hospitals and Universities

REASONS FOR HIGH PRODUCTIVITY

- Growth in commuter rail riders (8 percent per year for last 3 years)
- Additions to two commuter rail lines
- 45 percent of workers in downtown Boston use mass transit
- Stable population growth
- Cross-town bus routes

SYSTEM PROFILE

The actual service area of the MBTA is defined by the boundaries of Route #128 and includes 78 cities and towns. Both rapid transit and bus service are confined to these service area boundaries, while commuter rail service extends beyond these limits. The southern lines provide service as far south as Providence, Rhode Island, and two northern lines extend to the New Hampshire border. The transit system has undergone a transformation during the last 3 years.

Commuter rail travel has been growing at the rate of 8 percent a year for the last 3 years—this is actual growth, not shifting from other modes. Boston area population has been stable for the last 15 or 20 years, although there have been population shifts within the region during the last 10 years.

Generally, there has been outward movement into the more distant suburbs but still within the MBTA service area. This movement has caused a shift to commuter rail. According to management, riders prefer rail over bus, even with the added expense. There is pressure from rail advocates to increase the number of rail lines, but MBTA believes that in certain corridors, rail is not justified. Along the North Shore, for example, Express Bus service is more convenient than commuter rail. The buses are able to travel further into downtown Boston, reducing the number of riders who need to transfer.

RIDER PROFILE (US Census Data 1990)

- 14.53 percent Total Transit Use
- 59 percent Female
- 24 percent Immigrants
- 20 percent Black
- 69.5 percent Single

SERVICE CHANGES THAT AFFECT PRODUCTIVITY

- Commuter Services
  1. South Station has been completely rebuilt to accommodate Amtrak, private bus carriers, Express Bus Lines, and the commuter Red Line. South Station is considered to be one of the best rail stations in the country.
  2. North Station is also undergoing renovations to become a superstation. When completed, North Station will facilitate intermodal transfers, allowing for connections between commuter rail lines and heavy rail, without leaving the terminal.
  3. MBTA is adding two commuter rail lines. Last fall, the Framingham line was extended to Worcester, a previously unserved city west of Boston. Prior to the opening of the new line, Worcester was served only by private bus companies that carried 150–200 riders a day. Now with only limited service (i.e., three trips in the morning and three in the late afternoon), they are carrying 400 riders a day in each direction. After the completion of five additional stations between Worcester and Framingham in 1996, ridership is projected to rise even more.
  4. After the completion of the Middleborough-Plymouth line in 1996, projections are for a total ridership of 6,010, with 3,200 new riders being added to the system. This line serves the Southern Corridor, which has the added push of bad highway access and the worst highway congestion leading into downtown Boston. In terms of ridership and growth potential, this area of the state provides the best mass transit market.
- Cross-Town Bus Routes

  With the addition of three new cross-town bus routes, MBTA has been able to improve the quality of transit service to employees and patients at several hospitals and medical centers, and to faculty, staff, and students at several universities.

  These routes have limited stop service, more like the rapid transit system, and are aimed at linking these institutions, eliminating the need to travel into downtown and then out again. The purpose of these routes was to provide improved service for existing riders, not to generate new riders. However, current estimates are for 7,500 riders on these routes, one-third of them new riders. The MBTA will conduct a survey to identify the changes in ridership generated from this new service.
- Special Events
  1. Patriots Games. Two commuter rail lines serve the Patriots games, as well as two buses from the rapid transit stations. Games are sold out in advance, and people are taking advantage of transit services. It took time to generate a market, but now there are plenty of riders.
  2. Red Sox Games. On the Framingham Line, there is a station at Fenway Park that is only open for games. MBTA also adds extra service on its Green Line, before and after games, to North Station and Boston Garden.
  3. For annual events, such as the Fourth of July and New Years Eve, extra service is added, and for New Years Eve, transit service is extended. Trains that generally stop at midnight run until 2 AM.
  4. The biggest special event ever held was SAIL BOSTON. Tall Ships were in the harbor, and MBTA ran massive shuttle service from South Station to the waterfront. The shuttles carried 2 million riders a day. MBTA has never evaluated special events riders to determine if they become regular riders.

MONITORING PROCESS

For the first time since 1978, MBTA is conducting a bus study to evaluate ridership and system performance. Historically, they only tracked total ridership by mode. Now they are attempting to do their first comprehensive study, which they estimate, will take 2 years to complete. In 1993, they began the commuter rail survey, and in 1994, the light rail and heavy rail surveys were started. The current plan is to conduct systemwide on-board surveys every 6 years, and special projects surveys as needed.

FARE STRUCTURE AND PASS PROGRAM

Overall, there is an even split between riders who pay cash and those who use passes. MBTA estimates that 40 percent pay cash and 40 percent use passes, 8 percent of riders are seniors or have disabilities, 3 percent students, 4 percent chil-

dren, and 6 percent travel fare free (half authorized and half fare evasion). These percentages change according to mode, with riders on commuter rail using passes 63 percent of the time, and light rail riders using passes only 33 percent of the time. The Green Line (Light Rail) from downtown is so heavily traveled that when it switches from underground to surface travel, all doors are opened which results in 31 percent of outbound passengers traveling as authorized free riders.

There was a small fare increase in September 1991, raising the base bus fare from $0.50 to $0.60 which had no effect on ridership. Monthly unlimited use passes range from $20.00 for bus to $150.00 for the most comprehensive commuter rail pass which is valid on all lower level services. Combination passes, good on multiple modes, are available and priced according to mode and zone.

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NEW SERVICE CONCEPTS

- Community Bus Service Routes
- Simplified Intra-County Transfers

TARGET MARKETS/ USER GROUPS

Seniors, Disabled, and Trailer Park Residents
Commuters

REASONS FOR HIGH PRODUCTIVITY

- Population growth
- High percent wheelchair and senior riders
- Community bus service routes
- Restructuring of existing routes to eliminate deviations
- Reduction in frequency of service on selected routes
- Large Saturday ridership

SYSTEM PROFILE

Since 1988, an increasing number of riders who use wheelchair and mobility aids have been switching to public transit because of the limitations of existing paratransit services and the more reliable and less costly service for this population provided by the public bus system. BCt has had a steady 4 percent growth in ridership despite a fare increase in April 1995. Management credits this increase in ridership to heavy promotion of weekly and monthly passes marketed as an alternative to paying higher fares. Given that there has been no change in the size of the fleet in 5 years and a reduction in frequency of service, this growth trend was unexpected.

BCt serves a diverse market with year-round, seasonal, and tourist populations. Year-round riders are largely service workers traveling to hotels, restaurants, and hospitals, which accounts for Saturday service almost equivalent to weekday ridership. Although BCt recognizes the need to build service for the tourist and convention market, they have been unable to respond to the increase in demand during the peak season from November 1 to Easter.

RIDER PROFILE (US Census Data 1990)

• 2 percent	Total Transit Use
• 64 percent	Female
• 38 percent	Immigrants
• 59 percent	Black
• 10 percent	Hispanic
• 71 percent	Single

SERVICE CHANGES THAT AFFECT PRODUCTIVITY

- Disabled and Elderly
  1. BCt restructured existing routes by "straightening them out" and eliminating deviations into trailer parks. This service change was paired with the development of community bus service routes. BCt signed interlocal agreements with six municipalities to provide free shuttle service (one community imposed a fare of $0.25) with stops at senior centers, malls, hospitals, grocery stores, and so forth. The shuttles travel on 90-min fixed-route schedules with feeder service to the public transit system. BCt leases the mini-buses to municipalities for $10 a year, provides $18,000 a year for maintenance, and assists in the development of schedules and routes. The estimated annual cost to each municipality ranges between $50,000 and $75,000. Costs are kept down by using part-time retiree drivers and service hours adapted to passenger needs.

     This program was started in 1990 in one community, with participating municipalities added at the rate of one per year. Two additional communities are considering participation. Specific ridership information is not yet available; however, additional buses have been requested. To encourage rider input on design of routes and schedules, BCt will begin a needs assessment this month.
  2. The current fleet is 78 percent accessible, with a target date of January 1996 for 100 percent accessibility. Twenty-eight percent of the agency's riders are disabled or reduced fare elderly.

3. For riders with developmental disabilities or who are illiterate, the transit guide has been revised to code routes by color.

- Commuters
  1. Limited stop service during peak commute and reverse-commute hours has been expanded to accommodate residents at the western edge of Broward County where the greatest population growth has occurred. Currently, BCt has only one park-and-ride lot, although two additional lots are under consideration.
  2. Several bus routes have stops that facilitate transfers to Metro Dade Transit and Cotran (Palm Beach) bus lines. BCt also provides connecting service to Tri-Rail, a commuter rail system serving three adjoining counties, Broward, Dade, and Palm Beach. Operating for 5 or 6 years with funding from all three counties, Tri-Rail is not seen as competition by BCt. With elimination of state funding, Tri-Rail introduced a zone fare in mid-April of this year which led to a significant reduction in Tri-Rail's ridership. The rail riders may be using BCt instead.
- Tourist and Convention Market
  1. Although BCt recognizes the need to build service for the tourist and convention market, they have been unable to respond to the 15 percent increase in demand during the peak season from November 1 to Easter.
  2. Currently BCt contracts with a private company to provide service between the airport and the cruise ship docks. A 1-mi-long light rail link between the airport and the seaport is on the drawing boards. BCt supports this link as a way to reduce traffic on the roadways during the peak season.
- Special Events
  1. BCt recently signed a 10-year contract to provide shuttle service at the regular park-and-ride fare to the Air and Sea Show and the annual Fourth of July fireworks display.
  2. BCt continues to run charters to the Dolphin football stadium during football season at a round trip fare of $7.00 and regular and special routes to transport students to the fairgrounds during the Broward County Fair.

MONITORING PROCESS

1. BCt monitors 15 randomly selected full routes and segments each year and uses the information collected to modify scheduling. For example, riders connecting from east-west routes to north-south routes are now able to move through transfer points within 5 min.
2. In response to petitions asking for changes in service, telephone surveys are conducted to verify that petition signers are bus riders, prior to initiating any actual monitoring of the route in question.

FARE STRUCTURE AND PASS PROGRAM

A fare increase was initiated in April because of a $500,000 reduction in federal funding. The anticipated decrease in ridership did not occur, and there was a 14 percent increase in youth ridership and an overall increase of 4 percent. Management attributes this increase to the aggressive marketing of monthly ($30) and weekly ($8) passes. These passes are available to students, seniors, and disabled riders at half price and are good for weekend and summer use as well. They are easily purchased at public libraries, transit terminals, and the MTA store. County employees can get passes through payroll deduction.

ROUTE-SPECIFIC INFORMATION AS AN INDICATOR OF GROWTH TRENDS

The routes in BCt's service area that continue to grow the fastest typically cross several city and community lines, with stops at major destination points, and serve "a mixed bag" population. Route #1 provides service from the condo areas in So. Broward County to the airport and downtown terminal allowing riders to travel to either Dade or Palm Beach County with one transfer. Route #18 provides service for the largest inner-city minority neighborhood to a shopping center in Dade County, Margate Transit Terminal, and a community college campus. Route #36 provides service from the western most point in the county to the beach by way of a regional shopping center.

The least productive routes measured in terms of passengers per mile include the #87 Park and Ride Shuttle. Management suggests that poor ridership, typically six or eight passengers, is because of a frequency problem. On this route, there is one run in the morning and one run in the afternoon. Management suggests that a switch to mini-buses and a graduated pay scale for the drivers, based on the size of bus, would improve productivity on this route. The #75 is a one-way loop between the West Terminal and trailer parks. It makes 15 runs a day starting at 5:50 AM. Management would like to initiate a later start time in order to more effectively use resources. Buses on routes where early starts are unnecessary could be freed for use elsewhere. The #11 Beach Run provides service to professionals and other commuters unsuccessfully. Limited stop service is needed to attract riders to this route.

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Superintendent of Service and Planning

NEW SERVICE CONCEPTS	TARGET MARKETS/ USER GROUPS
• Route Restructuring	All Riders
• Six New Suburban Transit Centers	Reverse Commuters
• Improved Express Service	CBD Commuters
• Increased Service to Suburban Malls	Weekend Shoppers
• Barrier-free Self-service Zone on Light Rail	CBD Riders

REASONS FOR HIGH PRODUCTIVITY

- Elimination of non-productive service (plan to reduce service by 23 percent)
- Increase in passenger miles, longer trips from suburbs
- Fare increase in July 1995
- Major route restructuring to eliminate deviations and simplify the system
- Improved coordination of transfers with construction of six suburban transit centers

SYSTEM PROFILE

Buffalo, New York, is an urban area in northern New York state, with a population of 954,332. The transit system has a service area that encompasses two counties and an urbanized area with two urban centers, Buffalo and Niagara Falls.

The regional population has been stable, but there has been a shift in population growth from the inner city and inner suburbs to an outer ring of suburbs. In terms of employment, the region has suffered a loss in industry-related jobs and a consequent shift in population based on location of employment sites.

In the 1960s, an extensive expressway system was built based on growth projections that did not materialize. Therefore there is no highway congestion, unless construction or weather-related. This free flow of traffic, even during peak hours, works to the detriment of mass transit. There is also an abundance of inexpensive downtown parking, which further works against the growth of mass transit.

NFTA was founded in 1974 as a public bus system with service based on a fixed-route radial system. In addition to the fixed-route service, NFTA has several cross-town routes, express service from park-and-ride lots, and service between the two urban centers.

In 1985, NFTA added a 6.5-mi-long light rail system within the Buffalo city limits, with a barrier-free self-service honor system within a 1-mi radius of downtown. Ridership has fallen on light rail from a high of 30,000 passengers a day to a current ridership of 27,000 a day. Two years ago, NFTA started a major route restructuring program in an attempt to simplify the system with the elimination of route deviations and a focus on major transportation corridors.

As part of the route restructuring, express service was revamped and new route numbers assigned. The CBD is still the primary transit destination, although retail shopping and job sites are shifting from the inner city and inner suburbs to an outer suburban ring.

RIDER PROFILE (US Census Data 1990)

• 5.06 percent	Total Transit Use
• 66 percent	Female
• 6 percent	Immigrants
• 37 percent	Black
• 70 percent	Single

Ridership has been stable, although there was a slight decrease (10 percent) since last year. Riders are typically lower income, female (70 percent), and on work-related trips. Thirty-eight percent of all riders are on work trips, and 30 percent are public school students in grades 8 through 12.

SERVICE CHANGES THAT AFFECT PRODUCTIVITY

- Route Restructuring

  Two years ago, NFTA began a major route restructuring with plans to phase in changes over a 1½-year period. The purpose of the route restructuring was to simplify the system, by eliminating deviations and focusing on major corridors where the transit market was good. There were no costs involved in the restructuring; service remained at the same level.

  The new routing has only been in place for a few months, so it is too soon to determine the success of the project in terms of generating new markets. However, the restructuring project has had a positive effect on reverse-commute trips to the suburbs with a gradual increase in both ridership and passenger miles.
- New Transit Centers

  As part of the restructuring, NFTA constructed six new suburban transit centers at a cost of $2 million. These suburban transit centers have been operational since December 1994. The purpose of this project was to coordinate and improve transfers.
- Express Service

  Although there has been a decline in ridership, work trips to downtown remain the primary market and most successful aspect of NFTA's radial system. Because the length of trips and reverse-commute market have been increasing, express routes were renumbered and included in the route restructuring plan.
- Increased Service to Suburban Malls

  As part of the route restructuring, NFTA has increased weekend service to suburban shopping malls. According to management, these routes are among the system's least successful.

- Free-Fare Zone

  On the light rail line, within a radius of 1 mi of downtown, NFTA is utilizing a barrier-free self-service honor system. They spot check the system for abuses and feel that it works well with abuse limited to only 1 to 2 percent of riders.
- Special Events

  Special event service is provided by the light rail system. Regular service is utilized, and fares remain the same; however, extra cars are added to the trains. There is a terminal at the outer perimeter of the rail line which has a parking capacity of 14,000 spaces. Shuttle service to professional football games is provided with express buses from six suburban transit centers.

FARE STRUCTURE AND PASS PROGRAM

NFTA increased the base fare in July 1995, from $1.10 to $1.25. The zone surcharge of $0.20 remained the same, resulting in a $1.45 fare to the transit centers. It is too soon to tell the effect of this increase. Passengers who are seniors, have disabilities, or are children under 12 ride for half price.

Thirty-two percent of riders use monthly passes, which range in price from $44 a month for a one-zone pass to $53 for an all-zone unlimited ride pass. Twelve percent use student passes. These student passes are purchased by the school system and are valid only during school hours and on rides from home to school and back again. The student pass includes a photo for identification purposes. There is no surcharge for express service with either a cash fare or pass. NFTA is beginning to promote the idea of a pass program with employers. Five employers have indicated that they would participate.

MONITORING PRACTICES

The guidelines call for a comprehensive survey to be conducted every 4 or 5 years. However, the last on-board survey was conducted in 1988. According to management, there is no coordinated effort to monitor the system. Service changes are based on requests from individuals or businesses. Management characterizes the system as reactive, not proactive. At the present time, the agency is completing the annual customer satisfaction survey.

Agency: **CHAMPAIGN-URBANA MASS TRANSIT DISTRICT (MTD)**
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Operations Planner
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NEW SERVICE CONCEPTS	TARGET MARKETS/ USER GROUPS
• Three categories of service: community service, campus service, and evening/ weekend service • Shorter headways at night for security reasons • Low-floor buses on community routes • High-capacity buses on campus routes	University students, faculty, and staff
• Convention transportation service, primarily when classes are not in session	Conference attendees

REASONS FOR HIGH PRODUCTIVITY

- Compact service area (34 sq mi)
- University of Illinois, the dominant trip generator/attractor
- Pro-transit policies and practices on campus
- Frequent service
- Long span of service (until 2 AM)
- Campus and community services coordinated

SYSTEM PROFILE

The Champaign-Urbana Mass Transit District serves the twin cities of Champaign and Urbana, Illinois. The urbanized area has a population of 115,524. The University of Illinois dominates the area numerically and geographically. The university has approximately 35,000 students and about 15,000 faculty and staff. The campus straddles the line between the two cities.

MTD initiated campus service to supplement its network of community routes. Total system ridership increased dramatically. Prior to the change, MTD carried less than 3 million annual passengers. It carried 8.5 million in FY95. Systemwide productivity averaged 25 passengers per hour in FY89, prior to the new services; 41 passengers per hour in FY90, the first year of new services; and 53 passengers per hour in FY95, 6 years later.

Services are provided with a fleet of 80 buses. Its community routes are operated with full-size low-floor coaches. Most of its campus services are operated with 10 articulated coaches. One route to new buildings on the edge of campus uses a small, low-floor bus.

RIDER PROFILE (US Census Data 1990)

In FY90, the first year of the campus/community service concept, MTD carried 5.4 million passengers. This was an increase of 95 percent over the previous year, when MTD

carried 2.8 million riders. In FY95, 6 years after the start of the campus/community service concept, MTD carried 8.5 million passengers.

MTD operates three categories of routes: weekday community, evening/ weekend community, and campus. The distribution of ridership among these categories was as follows in FY90 and FY95:

	FY90	FY95
Weekday Community	59 percent	45 percent
Evening/Weekend Community	12 percent	19 percent
Campus	29 percent	36 percent
Total	100 percent	100 percent

MTD staff notes that the campus service behaves the opposite of the community service. For example, in bad weather, community service ridership goes down because many trips are discretionary; campus ridership goes up. The reverse is true in good weather.

University students, faculty, and staff ride community routes as well as campus routes. More than half of all riders are "I-riders," meaning those that show an ID card for fare payment. This fare category constituted 57 percent of the 5.4 million boardings in FY90 and 63 percent of the 8.5 million boardings in FY95. Ridership in all other fare categories is at a much lower level. For example, adult cash riders were 15 percent of the total in FY90 and only 7 percent in FY95. Annual pass riders were 10 percent in FY90 and 8 percent in FY95. School riders (high school and younger) were about 6 percent of the total.

POLICY CHANGES THAT AFFECT SYSTEM PERFORMANCE

The University of Illinois adopted several pro-transit policies as follows:

- Students elected to pay a semester transportation fee, which provides access to the entire public transit system by showing their ID card. Initially, the amount was $10. The current fee is $18 per semester.
- The University will pay 80 percent of the price of an annual transit pass for faculty and staff. The first new route provided access from a remote parking lot. Its success enabled the University to avoid the construction of new parking decks on campus. Further, more than 1,000 parking spaces have been eliminated on campus as a result of MTD services. Five million dollars' worth of new parking garage construction has been postponed along with the annual amortization, operating, and maintenance costs associated with these new facilities.
- The university also has a comprehensive TSM program to encourage carpooling and ridesharing and reduce the demand for faculty and staff reserved parking.
- The university raised its reserved parking fees more than 30 percent in 1989, and an additional 24 percent with escalating annual increases after 1990. This policy resulted in a 37 percent decline in student registered cars on campus.

On the Illini route, MTD "sacrifices" productivity for passenger security reasons. It operates more frequent service in the evening to shorten passenger waiting time. This results in more hours of service being operated at a time when fewer riders are being transported.

MTD operators provide up to $1.00 in change for passengers and sell tokens on-board the bus. These services are in effect on daytime service. Exact change is required after 7:00 PM.

SERVICE CHANGES THAT AFFECT PRODUCTIVITY

MTD began implementing the campus/community transit system in the fall of 1989. Previously, there was no campus-oriented service. The first new route introduced was a shuttle from a remote parking lot to campus. Other routes were added to provide frequent service for short trips around the campus area. These include the Quad route and the Illini campus circulator route.

The Quad route is in service from 7:30 AM to 5:30 PM, Monday through Friday, with a 5-min headway. The parking lot shuttle also is on a 5-min headway and operates a slightly longer span of service. The Scamp route to the new buildings on the edge of campus has the same span of service but operates with a 20-min headway. Finally, the Illini campus circulator route operates from approximately 7:00 AM to 2:00 AM. It is on a 15-min headway during the daytime. This same route operates every 10 min in the evening, so passenger waiting time is less.

Few changes have been made to the community services, yet. The distinction between weekday and evening/weekend service has existed within the system for many years. The intent in designing the campus/community service was to have the community routes bring people to the campus, where they can transfer to the campus routes. Campus routes also are used by those living on campus.

MTD also provides transportation services to conventions held in the area. Champaign hosts one conference every 3 years that attracts 20,000 people. Approximately 400,000 passengers trips are made during this conference. Smaller events also are accommodated. The service for these events does not disrupt regular transit services. Many occur when classes are not in session. When necessary, MTD will borrow buses from other transit systems to accommodate these events.

MONITORING PRACTICES

Routine farebox data desegregates ridership by route and by fare category.

On-board surveys are conducted periodically. A major study is done every 4 to 5 years and includes passenger attitudes, awareness, perceptions, and on-off counts. The last major study was oriented to the start-up of the campus/community service concept.

FARE STRUCTURE AND PASS PROGRAM

MTD achieved a farebox recovery rate of 34 percent in FY95. This is similar to its FY90 performance level of 33 percent. Prior to the introduction in new services (FY89), it recovered 25 percent of its costs from the farebox.

The basic cash fare is $0.75 per ride. A reduced cash fare of $0.25 is offered to senior citizens and persons with disabilities. Exact fare is required after 7:00 PM. Transfers are free. An all-day transfer good on Saturday or Sunday is sold for $1.50.

MTD sells tokens and a variety of passes. Nine adult tokens are sold for $5.00. Ten school tokens (high school and younger) are sold for $3. Twelve senior citizen/handicapped tokens are sold for $2. Tokens are sold by drivers on-board prior to 7:00 PM.

MTD sells annual passes, semester passes, and the Uni Pass. All require a photo ID card. The annual pass is good for any 12-month period. Prices are $150 for adults, $90 for school students (high school and younger), and $50 for senior citizens and persons with disabilities. Full-time University of Illinois employees can purchase a Uni Pass for $30, good for any 12-month period. MTD receives the balance of $120 for the annual pass from the university.

University of Illinois students pay an $18 per semester fee and ride free on any route by showing a valid student ID card. University faculty/staff ID cards are accepted on the campus routes. Students at Parkland College in Champaign can purchase a semester pass for $70. A pass for the summer session is sold for $35.

MTD also sells a summer flash pass for $15. When first introduced, the intended market was high school students. The flash pass is now directed at college students and younger. The summer pass is available to any student who was enrolled in any school in the previous spring.

Fares were increased from $0.50 to $0.75 on August 30, 1992. At the same time, discount tokens were introduced at a price of 10 for $5.00, which was equivalent to the old fare. MTD staff indicates that both ridership and revenue increased.

ROUTE-SPECIFIC INFORMATION AS AN INDICATOR OF GROWTH TRENDS

The entire MTD system averages a productivity level of 53 passengers per hour. MTD tracks passengers per hour for all routes on weekdays, evenings, Saturdays, and Sundays. The three strongest routes within the system all are campus routes: the Quad, Illini, and Shuttle routes. In FY95, the 12 weekday community routes carried between 31 and 69 passengers per hour. The strongest community route was the Orchard Downs route, which provides service to the married student housing complex and many of the Urbana dormitories. The weakest routes in the system are those operated on weekends and average about 26 passengers per hour.

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Manager of Transportation Alternatives

NEW SERVICE CONCEPTS	TARGET MARKETS/ USER GROUPS
• Cross-Town Service	Asians, other minorities, middle-class "choice" riders
• Center City Loop	Uptown workers
• Easy Rider Circulator	Non-transit riders, neighborhood residents
• BEATRUSHOUR Campaign	Peak hour commuters
• Commuter Caper	Uptown commuters

REASONS FOR HIGH PRODUCTIVITY

- Elimination of unproductive routes and services
- 30 percent growth in express riders in 1994
- High cost of parking

SYSTEM PROFILE

The transit system of the Charlotte Department of Transportation is characterized by an extensive system of radial routes and the recent addition of several cross-town routes. There are also commuter routes that extend into surrounding counties and cross the state line providing service for residents of South Carolina. The routes, with the exception of the four new cross-town routes, are on a radial system that rarely intersects—because of this, most riders must travel into the center of the city "uptown" before they can transfer.

RIDER PROFILE (US Census Data 1990)

Express riders on CTS are typically middle-aged white women, less than 40 years old, clerical and middle manage-

ment workers with 2 cars, and a car available for the work trip. They are primarily traveling from three small towns on the southeast side of Charlotte to "uptown."

SERVICE CHANGES THAT AFFECT PRODUCTIVITY

- Minority Workers and Choice Riders

  A year ago, CTS initiated cross-town bus service. This service was designed to reduce travel time by providing connectivity between remote areas of the city. With these new routes, the need for transfers and travel to the center of town was reduced. The cross-town route system allows riders to travel on one bus all the way from the northwest side of town to the northeast side where the university is located. If one imagines a clock face, only the area from 9 to 1 is currently without service. This new service costs about $75,000 a year. It is already considered a success because the goal of 13 passengers per hour has nearly been achieved.
- Uptown Workers

  At the urging of the City Council, CTS created a City Loop at the cost of $400,000 a year. This inner-city loop as well as a reverse-loop ran simultaneously in opposite directions. After an 18-month test period, the loop service was evaluated and discontinued. It was determined that this route did not attract any new markets and was carrying an average of only 8 passengers per hour.
- Disabled and Elderly

  CTS responded to a request from the Department of Parks and Recreation to provide a new route to the Marion Deal Senior Citizen Center. This center has a swimming pool equipped for persons with disabilities. CTS ran 10 trips a day at the cost of $80,000 a year. There are only two riders a day (probably 1 person traveling round trip). This service will terminate as of August 1.
- Out-of-State Commuters

  Two years ago, a consortium was established between the cities of Charlotte, North Carolina, and Rockhill, South Carolina, and the states of North and South Carolina. The purpose of the consortium was to provide transit service from Rockhill to Charlotte. Rockhill, South Carolina, is only 20 min outside of Charlotte, although across the state line. Rockhill is home to many people employed in "uptown" Charlotte.

  A limited-stop route, using over-the-road coaches, was introduced. Because the target riders are uptown commuters, service is provided only during peak hours. During the first year demonstration, Charlotte contributed $15,000 and the state of North Carolina contributed $50,000. Now that the demonstration is over, the state is no longer funding the project, so Charlotte is contributing $50,000. The goal of 200 passengers a day is within reach; the route currently has 150 riders with four trips. CTS considers this project a success, because it keeps more than 100 cars out of the city every day.
- Non Transit Riders and Neighborhood Residents

  The Easy Rider Neighborhood Circulator was introduced by the city to provide 12-passenger low-floor vans to two low-income neighborhoods. The neighborhood circulator was designed to facilitate travel to shopping, recreation programs, head-start programs, and prenatal clinics and provide feeder service to regular transit routes.

MONITORING PRACTICES

The most recent on-board surveys were conducted by CTS in 1990 and 1993. They are not generally used for marketing strategy, but to identify the needs of the non-rider.

The goal of the monitoring process is to "get those not on board, on board." By asking those riders already on board where they would really like to have the buses travel and where they need to go, CTS hopes to identify under-served areas and add routes in response.

FARE STRUCTURE AND PASS POLICY

Forty-four percent of CTS riders pay cash fares; the rest use some form of pass. There has been one recent fare increase which had no effect on ridership. The riders who are elderly or have disabilities pay half fare during non-peak hours and on Saturdays and Sundays, and students pay half fare on school days. Children traveling with an adult pay half fare anytime.

CTS sells monthly passes that are good for unlimited rides, including weekend use. The local pass costs $29 a month, and the express pass sells for $35 a month. CTS also sells a weekly pass for $7.00. Each month, 2,000 local, 11,000 express, and 13,000 weekly passes are sold. There are 20 outlets available for pass purchases, including a chain of grocery stores, and many employers purchase passes and then sell them to their employees. The city buys passes and sells them to their employees at half price, and the county purchases passes at full price and also sells them at half price. There is a summer pass available for students at a cost of $30.

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Contact: **Charlie Carson (1995)**
Director of Planning and Scheduling

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Assistant General Manager
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NEW SERVICE CONCEPTS	TARGET MARKETS/ USER GROUPS
• Cross-Town Services	Retail Shoppers/Workers Major Employers

REASONS FOR HIGH PRODUCTIVITY

- Elimination of under-utilized service
- Streamlining and modification of existing service to meet needs of current riders

FACTORS THAT INHIBIT GROWTH OF MASS TRANSIT

- Steady decline in population
- Downsizing of industrial sector (in some industries as much as 60 percent)
- Budget constraints that dictate caretaker function for CTTRANSIT
- Obsolete radial system (60+ percent of riders in Hartford do not have CBD as destination point)
- Extensive expressway system built for unrealized population projections
- Highway improvements that greatly reduce rush hour congestion on Interstate
- Competition with ride-share agency that operates vanpool and carpool service
- Inexpensive and accessible downtown parking (average $40/month or $4/day)
- High cost of express bus pass (average $80/month), peak hour service only

SYSTEM PROFILE

In the greater Hartford area, there has been a steady decline in population from 240,000 to 187,000 at the last census, and a corresponding decline in public transit ridership. Public bus service in Hartford is based on a traditional radial system with downtown pulse points, designed many years ago. The service area extends in a 30-mi radius from downtown Hartford and includes 25 park-and-ride lots and 15 express routes along main arteries into the CBD.

Although the entire fleet has been replaced since 1990, it consists entirely of standard 40-ft transit buses, which limits the amount of restructuring that CTTRANSIT is able to do. Travel patterns have shifted with industry downsizing. More than 40 percent of public transit riders do not have the CBD as a destination point and do not want to backtrack into downtown in order to reach their destination.

During the 1960s, an extensive expressway system was built based on growth projections that did not materialize. This highway system works to the detriment of mass transit. There is a free flow of traffic even in peak hours. Express routes have been losing ridership at the rate of 3 percent a year for the last 6 or 7 years.

Until the late 1980s, buses always ran full, with standing room only. Since industry downsizing and highway improvements, there are seldom standees and often empty seats. Ridership declined from 16 million in 1985 to 12.5 million in 1995.

RIDER PROFILE (US Census Data 1990)

• 19 percent	Market Penetration (percent of area population using CTTRANSIT in past month)
• 43 percent	Household Incomes of more than $20,000
• 60 percent	Female
• 38 percent	Black
• 33 percent	Caucasian
• 18 percent	Hispanic
• 56 percent	More than 35 years of age
• 41 percent	Employee full-time
• 14 percent	Employee part-time
• 16 percent	Own 2+ cars
• 35 percent	Own 1 car
• 46 percent	Own no car
• 20 percent	College graduate
• 19 percent	Some college
• 41 percent	High school graduate

Typically, passengers are poor and elderly, traveling cross-town to visit relatives, friends, or social service agencies, and to shop (there are only two supermarket chains in Downtown Hartford). These shopping and personal trips equal the number of work-related trips on public transit.

TRIP PURPOSE

• 22 percent	Work
• 23 percent	Non-grocery shopping
• 21 percent	Personal business

SERVICE CHANGES THAT AFFECT PRODUCTIVITY

- All potential user groups

  Changes in service have been limited to restructuring and redirecting of existing radial routes to reach new outlying destinations such as shopping malls and large-scale retirement communities.
- Students

  CTTRANSIT has no public school contract, no student passes, or arrangement with any community college or university. Student ridership is about 4 percent.

- Express Service

  CTTRANSIT has been losing riders on the suburb-to-city routes at the rate of 3 percent a year for the last 6 or 7 years. Express service operates at peak hours only and not all routes have comparable local service. Because of the radial system, it has been difficult for CTTRANSIT to provide reverse-commute service.

MONITORING PRACTICES

Until 8 years ago, CTTRANSIT did a complete survey of each route every 18 months. Comprehensive market research was conducted in 1995. A 5-year plan has been developed in response, involving data collection. Statistics are compiled monthly and compared with prior year performance.

FARE STRUCTURE AND PASS PROGRAM

There have been four fare increases since 1991. The base fare will have increased from $0.85 in 1991 to $1.50 in 1996. CTTRANSIT uses a complicated zone-fare structure with surcharges for express service. Until 2 years ago, fares for local and express service within the same zone were equal.

The Pass Program consists of a local or express monthly pass, and the cost is based on 20 rides per month, but rides are unlimited. Thirty-two percent of riders use these monthly passes. Because there was no picture or signature required, this pass could be used by other family members. With the new electronic fare boxes, this is no longer the case. There are no student, elderly, or disabled passes. There are 10-ride storage tickets which can be purchased.

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Manager of Service Development

NEW SERVICE CONCEPTS	TARGET MARKETS/ USER GROUPS
• Fast Track Shuttle (discontinued)	Downtown Workers
• Downtown Shuttle	State Employees

REASONS FOR HIGH PRODUCTIVITY

- Elimination of non-productive service
- Fare increases
- Interlining of routes
- Service evaluation team that strictly enforces performance standards

FACTORS THAT INHIBIT GROWTH OF MASS TRANSIT

- Headquarters for several automobile manufacturers
- Inexpensive and abundant downtown parking
- Population growth located in jurisdictions outside service area
- Competitive relationship with university-owned and -operated bus system
- 50 percent of downtown workers are state employees; state provides free to low-cost parking ($8/month)
- No congestion, so no incentive to reduce downtown traffic

SYSTEM PROFILE

The CATA system is based on a radial route pattern, with several pulse points and no transfer facility. There are 15 routes. Six of these routes carry 75 percent of the riders, with one of the six carrying 40 percent. The CATA service area is dominated by a large number of college students, who attend Michigan State University and Lansing Community College, one of the 20 largest community colleges in the country.

The students account for 60,000 out of a total population of a quarter million. CATA encompasses five jurisdictions, the City of Lansing, the City of East Lansing, where MSU is located, and three suburban townships, Meridien, Delhi, and Lansing Township. All are within the boundaries of Ingram County. CATA is authorized to serve the two adjacent counties, where most of the recent population growth is concentrated; however, neither have joined the transportation authority. CATA, in its current configuration, is unable to follow the growth.

Approximately 30 percent of workers commute on public transit. Express fares are very high, and there are no park-and-ride lots, so CATA cannot capture the suburban market in the township areas, where the population growth is occurring.

In 1987, in anticipation of budget cuts, fares were increased by $0.25. Ever since, CATA has been attempting to recapture the one million riders they lost during the 2-year period following the fare increase. Prior to 1987, the student population was guilty of significant abuse of the public bus system. There was heavy ridership among the students, however they were frequently paying the $0.25 youth fare, not the student fare. After the fare increase and better monitoring of abuses in the system, the student market decreased significantly.

SERVICE CHANGES THAT AFFECT PRODUCTIVITY

- Downtown Shuttle

  In 1990, in conjunction with the state government, CATA initiated downtown shuttle service that carried state

employees from the state parking lot, located on one side of the city, to the state office buildings on the other side of town. The state employs 12,000 workers in downtown Lansing. At its peak, the shuttle carried 300 passengers a day. Subsequently, the state built a close-in parking system for its employees, with prices ranging from $18 a month for covered parking spaces to free parking on gravel lots. Demand for the shuttle disappeared.

- Fast-Track Shuttle

  In early 1990, in the midst of a major downtown development campaign, the Lansing Downtown Development Agency allocated $32 million for 5,000 additional parking spaces. In the interim, they arranged with CATA to provide shuttle service from surface lots, located 2 mi from downtown Lansing. The cost was $25 a month for parking and shuttle service, and included two tickets per month for emergency mid-day taxi service back to the parking lot.

  From the summer of 1990 to 1993, this shuttle service carried 13,000 riders a month. In 1993, the city completed construction of a large number of low-cost parking spaces. Ridership declined to 10 or 20 riders a day, and the service was eliminated in late 1993.

- Special Events

  Michigan State University runs its own shuttle for all athletic events. CATA uses vintage trolleys for downtown festivals. The trolleys are considered a promotional tool.

- Route Interlining

  CATA has created a system of through routes, by renumbering buses as they pass through the downtown area and continue on. With interlining, 25 percent of CATA's riders can travel through downtown on one bus without having to transfer.

FARE STRUCTURE AND PASS PROGRAM

Twenty-six percent of CATA's riders use passes. There is a monthly pass priced at $35, and a student pass that costs $25. There is a flat fare of $1 on all services. Since 1992, there were two fare increases, which resulted in a loss of 8 percent per year in ridership.

MONITORING PRACTICES

CATA conducts on-board surveys every year and non-rider surveys every 2 years.

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General Manager

NEW SERVICE CONCEPTS	TARGET MARKETS/ USER GROUPS
• El Segundo Commuter Service	Aerospace Workers
• Community College Shuttle	Students, Faculty, and Staff
• Summer Shuttles	Tourists
• Lunch Hour Shuttle	Downtown Workers and Tourists

REASONS FOR HIGH PRODUCTIVITY

- Low fares
- Reliability
- Clean buses
- High passenger per revenue hour

SYSTEM PROFILE

The Santa Monica Big Blue Bus Line has been providing service since 1928. The philosophy of management is to provide high-quality, low-cost service on the street, so riders will not be "deflected." All buses are clean and the service is reliable; in fact, the Big Blue Bus Line has been cited as an example of how to maintain clean buses. Although the municipality of Santa Monica itself is only 8 sq mi, the service area of the bus system encompasses 51 sq mi. The Big Blue Bus Line provides primarily boulevard service and as such does not lend itself to route restructuring.

The bus system includes two types of service—express or freeway service into downtown Los Angeles during peak hours, which carries an estimated 2,000 riders per day, and local service with trips averaging 3 mi or 15 min, a market which is declining slightly. The Big Blue Bus Line carries 18 million riders per year—one-third of them travel entirely within Santa Monica, one-third within Los Angeles, and one-third cross from one to the other.

Ridership peaked in 1980 and then declined by 8 or 9 percent after the riots which eliminated service along Pico Boulevard. In general, ridership on the Big Blue Bus Line is more dependent on the economy than on service changes.

RIDER PROFILE (US Census Data 1990)

• 6.34 percent	Total Transit Use
• 53 percent	Female
• 68 percent	Immigrants
• 14 percent	Black
• 9 percent	Asian

- 64 percent Hispanic
- 66 percent Female

In Los Angeles, there is no tradition of public transit; ridership is economically determined. The Big Blue Bus Line is targeting those riders who are marginally using an automobile, where the car is not necessary for work trips. They are aiming at clerical workers and entry-level professionals who could save money on parking and insurance by riding the bus.

Fifty percent of the Big Blue Bus Line riders earn less than $20,000 a year, and at the high end are the express riders into downtown Los Angeles. Management has also noticed marked growth in the Hispanic market which it is targeting through the Catholic Church. In general, the Big Blue Bus Line has a 6 to 10 percent market share of riders traveling to work and a 13 percent market share of students traveling to UCLA.

The Big Blue Bus Line has increased the reverse-peak market. In response to a request for earlier service from stock brokers who needed to arrive in downtown Los Angeles before 6 AM, earlier trips were introduced. On these early runs to downtown, the buses were carrying 15 passengers. However, on the return trip there were an unanticipated 55 riders. An extra trip had to be added which leaves downtown at 6:10 AM. The passengers on this first trip are day workers and domestics, who are new riders to the system.

SERVICE CHANGES THAT AFFECT PRODUCTIVITY

- Commuters

  El Segundo Commuter Service

  Last October, the Big Blue Bus Line introduced commuter service between Santa Monica and El Segundo, with funding from air quality management and a gas company grant. El Segundo is a major employment center for the aerospace industry. Several aerospace employers, including TRW and Hughes, are within a compact area. The route was designed by getting addresses of potential riders from employers, plotting residences on a map, and creating a route to serve the maximum number of workers. Four 30-ft buses with plush reclining seats, televisions, and video players are being used for this 45-min trip. So far, it has had limited success. Although the buses are designed to hold 25 passengers, they are currently getting only 10 riders per trip, or 40 to 50 passengers a day. However the new riders are fiercely loyal, and prior to the introduction of the service were traveling alone in private vehicles. The fare for this 20-mi-long trip is $2.00 each way.
- Students

  Community College Shuttle

  After the Northridge Earthquake, the community college in Santa Monica lost its parking structure. The school pays a flat fee to the Big Blue Bus Line to provide shuttle service from a remote parking lot to the college campus. All day and evening service is provided for 800 passengers a day. The college does the marketing and the promotion; the Big Blue Bus Line does the scheduling and routing.
- Tourists

  Free Summer Shuttle

  During the summer, the hotels sponsor a free shuttle that travels between the two major shopping areas (the Promenade and Main Street). Twenty-five-ft-long 22-passenger buses carry 500 to 600 riders per day.

  Lunch Hour Shuttle

  Also during the summer, the downtown business district promotes a shuttle that circulates during the lunch hour between the Colorado Business Park and downtown Santa Monica. This free service is used by tourists and downtown workers.
- Special Events

  The Big Blue Bus Line has been providing shuttles to the Rose Parade for many years and has a package that includes transportation plus a ticket to the parade. They typically use 15 or 20 buses, but if the economy is good, they may have to use as many as 30 buses.

  The Big Blue Bus Line provides shuttles to fairs and festivals as the opportunity presents itself. This line has never provided service for athletic events—such service does not work in Los Angeles because the freeway system and parking facilities are too accessible.

  The Big Blue Bus Line runs monthly tours, as a nonprofit item, to promote their community image—not to generate new riders. Fares are charged that cover expenses, and three to five buses are used to travel to specific locations such as Theater in Orange County or an apple festival.

MONITORING PRACTICES

Santa Monica conducts a study every 3 years on all routes. On a daily basis, staff keep tabs on the needs and opinions of riders by distributing "green sheets" which are returned to operators. This may lead to service changes, such as adjusting service on overloaded routes by reducing headways or increasing frequency. New routes are not needed; lack of accessibility to buses is not an issue.

FARE STRUCTURE AND PASS PROGRAM

The Big Blue Bus Line does not use passes. There are punch cards for students who account for 15 percent of riders. The punch cards are available for students under 21 who are enrolled in public or private school and may be used only for transportation to and from school.

The local fare is $0.50 and has not changed since 1983. In 1991, there was an increase in the express fare from $0.80 to $1.25. Transfers are free for the Big Blue Bus Line buses and

cost $0.25 if changing to another bus line. Schedules are designed so that buses pulse out of downtown at night, facilitating transfers between lines.

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NEW SERVICE CONCEPTS	TARGET MARKETS/ USER GROUPS
• Expanded Peak Period Express Routes	Commuters
• Timed Transfer Centers	Commuters/Seniors/ Students
• Adopt-a-School Program	Students
• Metrolink Shuttle Routes	Commuters

REASONS FOR HIGH PRODUCTIVITY

- New subregional transit operator providing service on lines formerly operated by a large, regional operator
- Extensive service expansion
- Increased ridership on commuter express lines
- Employer incentives for public transit users
- Discounted transit passes
- Foothill's response to LACMTA strike resulted in many new riders; a large number have been retained
- Special lines implemented after January 1994 earthquake serve more riders in and out of Los Angeles

SYSTEM PROFILE

Foothill Transit is a unique "public-private partnership" in the delivery of public transit services. Foothill Transit was established as the San Gabriel Valley Transportation Zone, which encompasses the eastern portion of Los Angeles County known as the San Gabriel and Pomona Valleys. The service area of 327 sq mi consists of 20 cities and adjacent unincorporated areas of Los Angeles County.

Foothill Transit began operating transit service in December 1988, replacing service formerly provided by the regional transit operator (SCRTD, now LACMTA). The zone was created to operate 14 transit lines. Currently, Foothill Transit operates a total of 21 lines, including 10 express lines and 11 local lines. These services require a fleet of 215 buses.

Foothill Transit is publicly owned and controlled and privately operated. It has no employees of its own. All services are performed by contract with private firms, which provide all dispatchers, drivers, mechanics, fuel, parts, insurance, a bus yard, and road supervision. The management and administrative services are provided through a management services contract.

Foothill Transit has attracted additional riders each year of its operation. In FY94, there were more than 11 million passenger boardings. Passenger productivity, measured as passengers per hour, has remained in a range of about 27 to 30 passengers per hour for the past 6 years. Annual fluctuations reflect service expansion, downturns from the local economy, and the response to external events including earthquakes and a strike at LACMTA.

Since its inception in 1988, Foothill Transit has consistently provided transit services at significant savings compared with the costs of the previous operator. Foothill Transit prepared the following comparison of its recent performance with the estimated performance on the same lines operated by the SCRTD, assuming the LACMTA continued to operate these lines:

	LACMTA Equivalent Operations 1994	Budgeted Foothill Transit 1995	Difference
Operating Cost	$34,791,542	$24,144,630	(30.6 percent)
Farebox Revenue	$7,202,935	$10,500,000	45.8 percent
Subsidy Required	$27,588,607	$13,644,630	(50.5 percent)
Vehicle Service Hours	277,569	435,000	56.7 percent
Boardings	8,025,620	12,000,000	49.5 percent
Peak Buses	119	190	59.5 percent
Cost per Passenger	$4.34	$2.01	
Cost per Hour	$125.34	$55.50	
Passengers per Hour	28.9	27.6	
Farebox Ratio (Revenue/Cost)	20.7	43.5	

Data Source: Foothill Transit

Essentially, Foothill Transit is operating more service, carrying more passengers, and incurring lower costs. Its performance in selected indicators also shows improvement over the LACMTA equivalent operations, with passenger productivity showing only a slight decline while operating significantly more service.

RIDERSHIP PROFILE (US Census Data 1990)

Foothill Transit carried 11,052,000 passengers in FY94. Almost one-half of these riders (5,135,907) were carried on express services on weekdays. Another 3,120,965 were transported on local services on weekdays. The balance were weekend riders.

Foothill Transit has registered ridership increases each year that it has operated. During the past 3 years, its ridership rose from 6.9 million in FY92, to 9.8 million in FY93,

to 11.1 million in FY94. Its passenger productivity during these same years has ranged from 27.2 to 28.0 passengers per hour.

SERVICE CHANGES THAT AFFECT PRODUCTIVITY

- Commuters—New service has been added to areas previously unserved. A prime example is Route 690, a peak-period express service begun in 1991 between Montclair and Pasadena. This represents the first commuter express service oriented toward an employment center other than downtown Los Angeles. Metrolink train riders constitute a specific new market being targeted; three new shuttle routes are scheduled to start in November 1995.
- Transfers—Foothill Transit is implementing a network of eight timed transfer centers. The specific locations were developed based on an extensive study, including a rider survey, that identified a major concern among transit users as the inability to smoothly transfer from one line to another. The timed transfer system is being designed to guarantee that connections between bus lines are made easily.
- Students—The current marketing plan targets students on the local routes through participation in community "Adopt-a-School" programs.
- Outreach to Hispanic Community—Foothill Transit estimates that between 20 and 30 percent of its ridership is Spanish-speaking. FT is committed to developing appropriate communications campaigns which appeal to current and prospective Hispanic riders. This outreach effort includes preparing bilingual versions of printed materials and targeting publicity efforts to media outlets serving the prospective Hispanic customer.

MONITORING PROCESS

Foothill regularly monitors the travel needs of ridership segments to determine where the greatest demand is and to schedule appropriately. The largest effort to date has been the COA/Strategic Master Plan of 1994, which addresses each community in the service area in terms of demographics, transit usage, and latent transit demand. Every existing bus line was evaluated; many of the lines had not been altered significantly since they were transferred to the zone from SCRTD/LACMTA (mostly between 1988 and 1991). Comprehensive service changes and expansions were proposed and are being implemented as a result.

In FY94-95, Foothill initiated an Attitudes and Awareness Study. Results of this study will allow FT to more accurately profile the demographics of its riders and to develop marketing messages that will be more effective in reaching potential customers.

FARE STRUCTURE AND PASS PROGRAM

Local riders pay a flat fare of $0.85. Express riders are charged a premium, which is based on the length of the non-stop freeway portion of the trip, including the El Monte busway. There are five different express zones. Seniors and citizens with disabilities pay a reduced fare of $0.40 with no express zone charges. Students using a monthly pass or Metrocard pay a reduced fare of $0.60. Transfers are available between routes and to/from other connecting systems for $0.10.

Monthly passes are available for the above categories. Also, there are joint Foothill/LACMTA monthly passes. Foothill Transit also is a participant in the regional Metrocard stored-value debit-card program.

There have been some limited-time marketing promotions that include special fares or fare coupons or special deals with local business that can be obtained by showing a valid monthly transit pass.

Foothill's base fare has remained at $0.85 since it began operating in 1988. During the same period, the regional operator increased its base fare to $1.35.

ROUTE-SPECIFIC INFORMATION AS AN INDICATOR OF GROWTH TRENDS

The greatest ridership increase is on Foothill's commuter express lines. Total boardings on the express routes rose by 88 percent between FY92 and FY94. At the same time, the level of service expanded: there was an increase of 67 percent in revenue vehicle hours and 59 percent in miles.

The fastest-growing routes in Foothill Transit's service area include Route 187, a local route providing east-west service through the length of the service area, along the northern tier; Route 480/481, a freeway express service that also operates via local streets, especially in the more distant areas; Route 498, a freeway express commuter service that operates directly between downtown Los Angeles and the suburban points, with few intermediate stops.

Inter-county service between Los Angeles County and neighboring San Bernardino County has traditionally been a weak link. Providers rarely crossed county lines, leaving a 2-mi void and limiting through travel. In response to this issue, Foothill established Line 480 in July 1994, providing service to the Montclair Transfer Center. The Montclair Transfer Center is the main link between Foothill Transit and bus service in San Bernardino and Riverside Counties, operated by Omnitrans and the Riverside Transit Agency. Currently, Omnitrans coordinates its bus schedule with Foothill Transit service at the center to provide customers with convenient transfers. In February 1995, Foothill expanded service on Line 690 from Clarement to Montclair. Foothill receives some of its ridership from Park-and-Ride users at the Montclair Center. The center is also the site of a daycare facility.

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NEW SERVICE CONCEPTS	TARGET MARKETS/ USER GROUPS
• Express Service from Park-and-Ride Lots	Out-of-County Comuters
• Local Service to Employment Centers	In-County Commuters; Major Employers
• U-Pass Program	University of Washington Students/Faculty/Staff
• Vanpool Program	Target Employers/ Employees
• Community-Based Service	Lower Density Areas

REASONS FOR HIGH PRODUCTIVITY

- Effective route restructuring
- Customized routes to major employment centers
- Expanded vanpool service
- High development area

SYSTEM PROFILE

Snohomish County is just north of Seattle in the growing Puget Sound Region. The county has an area of 1,300 sq mi and a population of more than 510,000 people. Snohomish County Public Benefit Transportation Area (PTBA), called Community Transit (CT), was created in 1975. CT is the primary provider of public transportation in Snohomish County.

CT provides local and commuter fixed-route transit services. Local routes are designed to provide basic mobility within the PTBA and access to transfer opportunities. CT local service is operated using 122 standard and articulated transit coaches. Commuter routes operate predominantly in peak directions and during peak periods and are designed toward specific employment-related destinations. Commuter route design emphasizes the park-and-ride lot system in the county. The commuter routes serve downtown Seattle, Bellevue, and Redmond. This service is provided by a contractor, using a fleet of 89 coaches.

CT also provides In-County Commuter service on 11 local routes to the Boeing Everett plant, customized to meet that employer's needs. CT's vanpool program leases vans to qualified commuter groups with an origin or destination in Snohomish County. Currently, CT operates 75 vans from its fleet, which was recently expanded to 142 vans. Three vans are lift-equipped. Some 83 percent of the vanpools operating today travel to Snohomish County employment centers.

Community Transit recognizes that fixed-route transportation is not the answer to all transportation needs in the PTBA service area. CT is emerging from its traditional role as a bus company and is positioning itself as a market-driven company. The transition from a product-driven agency to one that is market-driven will feature new roles for vanpool/carpool programs, local bus operations, and community outreach initiatives. CT is aggressively developing innovative ways to tailor service in transportation pockets by using demand-response, smaller buses, and an increased emphasis on vanpools and carpools.

RIDERSHIP PROFILE (US Census Data 1990)

CT carried 5.4 million total riders in 1994. The distribution by service type, provided below, shows the relative strength of the local and intercounty commuter markets:

	Annual Riders	Percent of Total
Suburban/Local	2,276,660	42.2
Inter-County Commuter	1,912,121	35.4
U-Express	599,296	11.1
In-County Commuter	264,954	4.9
Vanpool	206,450	3.8
DART	138,787	2.6
TOTAL	5,398,268	100.0

CT has registered continuous ridership increases over the past 5 years. Over the past 3 years, average weekday boardings for the bus system as a whole have increased from 17,481 in 1993 to 20,507 in 1995, an increase of 17 percent. These trends were not consistent by service type, however, as follows:

Average Daily Boardings

Percent Service Type	1993	1994	1995	Change
Local	6,568	7,087	9,188	39.9
Intercounty Commuter	7,432	7,300	7,943	6.9
In-County Commuter	1,164	1,052	903	-28.9
University Boardings	2,317	2,626	2,473	6.7
Bus System Total	17,481	18,065	20,507	17.3

CT staff indicated that ridership on all commuter routes was increasing steadily until 1992 when the definition changed for high-occupancy vehicle (HOV) lane use. Vanpool ridership was expected to hold steady or decline slightly in 1994 because of dramatic personnel shifts and layoffs at Boeing-Everett.

The entire CT bus system averages a productivity level of 21.8 passengers per hour. As shown below, productivity varies by service type as follows:

Service Type	Passengers per Hour
Local	17.3
In-County Commuter	14.9
Intercounty Commuter	30.9
University	31.8

SERVICE CHANGES THAT AFFECT PRODUCTIVITY

- *Customized Routes*—CT operates In-County Commuter Service consisting of 11 routes serving Boeing, the largest employer in the county. These routes are open to the general public but customized to meet Boeing's needs.
- *University Service*—To serve the University of Washington, a U-PASS program was introduced in 1991 by a partnership of Community Transit, Seattle Metro, and the University. The U-PASS is a flexible package of transportation benefits that allows students, faculty, and staff to choose from various commuting options at a greatly reduced price.
- *Expanded Vanpool Service*—Vanpool service has been expanded to better serve the commuter market. Vanpool ridership experienced a 73.6 percent increase between 1991 and 1994.
- *Local Route Restructuring*—The South County Route Network Analysis led to overall fixed-route system changes in 1992. These changes included individual route and schedule adjustments, and changes in the fundamental local network orientation. Two routes were terminated; most of the remaining routes were changed. A South County transit center was established west of Highway 99, eliminating forced trips to the Lynnwood transit center for those who wish to transfer to the Highway 99 corridor.

  The North County route changes in 1993 resulted in a 5 percent overall increase in ridership. Two routes were discontinued, two routes were added, and several routes were expanded. Time adjustments enhanced weekday service on several routes, including minor time adjustments on Routes 210 and 280. Average weekday boardings on Routes 210 and 280 increased by 75 percent and 77 percent, respectively. Ridership more than doubled on both new routes in their second year.
- *Community-Based Services*—In new subdivisions, and particularly in the less densely populated parts of the service area, alternatives to fixed-route bus service may prove more attractive. Services oriented only to a specific residential area with connections at a community center to the fixed-route bus network could provide service tailored to the community's needs.

MONITORING PROCESS

CT evaluates its operations based on annual performance in the following six performance centers: Local Fixed-Route Service; In-County Commuter Service, Commuter Service; University Service; Disabled Service; and Vanpool Service.

The MPO does annual modeling. Community Transit uses this as input to conduct geographic analyses.

An on-board survey was conducted in July 1993 as part of a regional project to measure transit ridership and overall traffic patterns. In 1993, CT hired a firm to conduct a system market research study (SMRS) to analyze its routes and target markets and to provide input into structuring for the future. This study was completed in 1994. The foundation of the SMRS project was the telephone survey of 1,603 households in Snohomish County, conducted in May/June 1993. The survey profiles both current customers and noncustomers in terms of demographics, current transportation behaviors, and attitudes. Five distinct groups were defined, ranging from Group A ("pro-bus") to Group E ("pro-car"). The five groups are as follows:

- Group A: 24 percent of Snohomish County population; strongest pro-transit responses; concerned about future traffic and environment;
- Group B: 16 percent of Snohomish County population; supporters of pro-transit issues; still feel safe in their cars;
- Group C: 18 percent of Snohomish County population; most uncomfortable with new things and new people; smallest percentage of commuters;
- Group D: 25 percent of Snohomish County population; will stay in car if gas prices are low; starting to feel unsafe in their cars; and
- Group E: 17 percent of Snohomish County population; pro-car attitudes; will always choose their car—convenience is a major factor.

The SMRS concluded that those individuals that constitute Groups A and B and a small segment of C are the primary targets for conversion to transit users. Based on the data collected, this segment constitutes 50 percent of the total marketplace and 64 percent of the commuters in the county. Almost half (49.6 percent) of this segment currently commutes by single-occupant vehicle. Therefore, according to the SMRS, the potential for increasing market share exists within the three most promising groups.

FARE STRUCTURE AND PASS PROGRAM

Current fares for local service are $0.80 with a reduced fare of $0.40 for seniors and those with disabilities. Fares for the In-County Commuter are $1.00. A fare of $1.50 is charged for Commuter (Express) service, with a $0.75 fare for seniors and those with disabilities. Fares for the

U-Express are $1.35 regular and $0.65 for seniors and those with disabilities.

Ridership by fare category in 1994 was as follows:

Category	Percent
Local	45.1
Commuter	37.8
University	11.9
In-County Commuter	5.2
TOTAL	100.0

Local, commuter, and university riders can purchase monthly or annual passes; in-county commuter riders can purchase a monthly pass. Also, a local all-day pass is available to provide unlimited rides for the price of a round-trip fare.

A fare increase was implemented in 1991 to keep fares in line with inflation. Ridership continued to increase despite the fare increase. CT also has experienced a growth in revenues from sales tax and gas tax.

ROUTE-SPECIFIC INFORMATION AS AN INDICATOR OF GROWTH TRENDS

Commuter express service on I-5 is Community Transit's most recognized and most successful service. It serves a well-defined consumer need and is the only current market where transit can be competitive with the single-occupant vehicle.

Two of the top performers, Routes 610 and 210, are local routes that bisect the dense portions of the PTBA. These two routes carry nearly 15 percent of CT passengers.

In addition to Route 610's performance indicating the importance of Highway 99, Route 620 also travels along Highway 99 for a portion of the route. Route 620 is the fifth best route in the system. The activity associated with the Highway 99 corridor and its proximity to residential areas make it an important transit corridor from the perspective of CT's riders.

The strength of the current market for commuter service to downtown Seattle is also shown. Five of the top ten heaviest traveled routes in the system are in this category. Currently, as many people use commuter service to Seattle as use local fixed route. As of Spring 1994, there were approximately 3,500 trips to downtown Seattle and 1,300 trips to the U-District daily.

The SMRS suggests that the future growth of the King County commuter market will not be in downtown Seattle or the U-District but will be oriented to the I-405 corridor east of Lake Washington and other employment sites in north Seattle between South Lake Union and the Northgate area.

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NEW SERVICE CONCEPTS	TARGET MARKETS/ USER GROUPS
• Electrification of Ronconcomo Line	Commuters (Discretionary Riders)
• New Parking Garage	Kiss and Ride Commuters
• Shuttles to Rail Stations	Commuters Traveling from Stations with Inadequate Parking
• Dual-Mode Trains	Commuters to NYC Transferring at Jamaica Station
• Rehabilitation of Penn Station	Commuters
• Planned extension of LIRR to Grand Central Station	Commuters

REASONS FOR HIGH PRODUCTIVITY

- Increased capacity using bi-level coaches
- Reduced travel time
- Elimination of transfers
- Service adjustments (reallocation of trains)
- Shuttles to rail stations
- 15 percent fare increase in 1990
- 93 percent reliability

SYSTEM PROFILE

The Long Island Rail Road, originally a branch of the Pennsylvania Rail Road, was purchased by the State of New York in 1965 and is managed by the MTA. It operates as a commuter rail system, with nine separate branches, and provides service from Long Island and the borough of Queens into Manhattan. The service area of the LIRR encompasses 3,990 sq mi with a population of 11,720,000. Average ridership for weekday trips is 325,000.

At peak travel times, this commuter service operates at capacity or exceeding capacity, so attempts to develop new service concepts for the choice riders in this market focus on reducing travel time and improving accessibility and parking at the 134 rail stations.

The price of automobile travel into New York City is extremely high, traffic congestion is horrendous, and when tolls and parking costs are included, more expensive and

more time-consuming than traveling on the LIRR. Consequently, the LIRR has a 73 percent market share of peak commuter travel from Nassau and Suffolk counties into New York City.

There has been a general system wide decline in commuter ridership (approximately 1 percent), attributed primarily to unemployment factors. Although off-peak ridership is up, there is not enough of an increase to offset the commuter decline, so revenue was down at the end of the last quarter.

Parking is an issue at many stations. Ridership exceeds the parking capacity. Management believes that if they could increase parking, they could increase ridership.

RIDER PROFILE (US Census Data 1990)

- 46 percent Total Transit Use
- 63 percent Female (bus)
- 49 percent Female (subway)
- 38 percent Immigrants (bus)
- 43 percent Immigrants (subway)
- 30 percent Black
- 21 percent Hispanic
- 60 percent Single

The average rider on the LIRR is a commuter riding by choice (73 percent market share), who remains a loyal patron for an average of 9 years. There is also a small reverse-commute market, a leisure market that uses the trains to reach the beaches at the East End of the island (14 percent market share), and an off-peak market that uses the trains for shopping and theater (30 percent market share).

There has been a demand shift among early morning commuters. With an earlier arrival time in the city, ridership has increased by 20 percent on those trains, from 580 riders to the 700 range. Comfort is an important issue for those riders who travel a long distance. The LIRR is attempting to improve the seating in its newer coaches to attract riders.

SERVICE CHANGES THAT AFFECT PRODUCTIVITY

- Commuters
  1. Electrification of the Ronconcomo Line

     In 1987, the main Ronconcomo Line, at the eastern most edge of the LIRR commuter area, was electrified, reducing travel time from 1½ hr to 1 hr on the 51.5 mi stretch from Ronconcomo into the city. By converting this route from diesel to electric, riders were able to eliminate the transfer at Jamaica Station, the last stop before entering the tunnel into Manhattan. Diesel engines are not allowed in the tunnels entering Manhattan. This change generated a tremendous increase in ridership, resulting in the addition of a train since 1990. This line still continues to show growth in all segments of the market from construction workers to white collar workers.
  2. New Parking Garage

     The parking area at the end of the Ronconcomo Line was at capacity and needed to be expanded. During the summer, a new parking structure was completed providing more than 1,000 parking spaces. The new garage has not changed ridership numbers; the intent was to relieve the parking problem. Riders are assessed a $25 per month parking fee to offset the cost of the facility which was $9 million. At this point, riders are still reluctant to pay for parking, and in November rail fares are increasing from $180 a month to $200 a month, a 25 percent increase, if one includes parking costs, over what commuters were paying earlier this year. The Master Plan for the LIRR includes changing all free surface lots to pay lots.
  3. Feeder Shuttles

     The LIRR added a fixed-route neighborhood shuttle in Farmingdale in an attempt to alleviate parking problems at that rail station. The shuttle provides feeder service to trains that are not at capacity. The Port Jefferson line has a similar feeder shuttle at milepost 52 that was introduced 3 years ago. An additional shuttle is planned for the Stonybrook area which is experiencing similar problems.
  4. Reverse-Peak Train

     A reverse-peak train was recently introduced on the Port Jefferson line to build that market. The service has not been very successful because of frequency problems. It has been difficult to promote the reverse-peak market since there are not enough trains available when needed. On branches where the line is double tracked, like Garden City or Hemstead, the reverse-peak market could be targeted.
  5. Dual-Mode Trains

     LIRR is purchasing dual-mode trains for its Port Jefferson line. Because diesel trains cannot travel through the tunnel into the city, all trains must stop at Jamaica Station and passengers must transfer to electric trains. Switching to dual-mode trains eliminates the need for transfers at Jamaica Station and reduces travel time by 12 min. With the new equipment and platform extensions, the LIRR hopes to increase the number of trains during peak hours from 38 trains per hour to 42 trains per hour.
  6. Pennsylvania Station Rehabilitation

     The rehabilitation of Pennsylvania Station was completed last year. The cost for the renovations was $200 million. The new, clean, air-conditioned station has improved passenger flow and generated considerable positive exposure.
- Special Events

  During peak hours, trains already operate at capacity, so the LIRR cannot provide special event service during those

times. Service is provided for annual events such as the U.S. Tennis Open with special stops at Shea Stadium Station, and the U.S. Golf Open at Southhampton which increases ridership by 5,000. Events at Madison Square Garden, such as Rangers hockey games and the Democratic National Convention are easily served by existing service and do not create new markets.

FARE STRUCTURE AND PASS PROGRAM

Thirty percent of all passengers pay cash fares: 8 percent pay full cash fare and 21 percent pay off-peak cash fares. Seventy percent of total riders use monthly passes, with 95 percent of commuters using monthly passes. There is a promotional child's fare of $0.50 for up to four children per adult. This fare is used primarily for public relations purposes, not to generate revenue. An average 9 percent fare increase has been proposed for November 1995, weighted by zone.

MONITORING PRACTICES

Customers are surveyed annually using origin and destination studies. Surveys are distributed on platforms and trains and with mail-and-ride tickets. Service adjustments are made in response to rider counts. Trains are reduced by the number of cars that are underutilized and put on branches that need them for growth.

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NEW SERVICE CONCEPTS	TARGET MARKETS/ USER GROUPS
• None	None

REASONS FOR HIGH PRODUCTIVITY

- Fare increase in 1992

SYSTEM PROFILE

RTA in New Orleans operates traditional bus service and light rail service into downtown and provides most of the public school transportation for the district. There is also limited service for the tourist market.

RIDER PROFILE (US Census Data 1990)

• 9.11 percent	Total Transit Use*
• 61 percent	Female
• 6.7 percent	Immigrants
• 72 percent	Blacks (bus)
• 87 percent	Blacks (light rail/streetcar)
• 72.5 percent	Singles

*Commute to work

MONITORING PRACTICES

RTA conducts on-board surveys every 3 to 5 years. These surveys are not used for marketing purposes but could be used for decisions concerning service changes.

FARE STRUCTURE AND PASS PROGRAM

Five percent of RTA passengers use passes; 95 percent pay cash fares. The 5 percent that use passes are a combination of workers, public school students, and tourists. Monthly passes marketed for workers are sold for $40 a month. Public school students receive passes paid for by the school system. RTA considers the student population to be their most successful market segment. For tourists, there are two types of passes: a 1-day pass sells for $3.00 and a 3-day pass sells for $8.00.

The base cash fare is $1.00 with a $0.10 transfer fee. The fare for Elderly and Handicapped (E and H) is $0.40 for fixed-route service and $1.00 for wheelchair-lift service.

ROUTE-SPECIFIC INFORMATION AS AN INDICATOR OF GROWTH

The most successful and fastest growing route in the RTA system is the Riverfront Streetcar. It provides service to leisure riders, primarily the tourist market.

Also successful and growing are two express routes that provide commuter service from middle-income suburban areas.

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NEW SERVICE CONCEPTS	TARGET MARKETS/ USER GROUPS
• "Edmonton-style" timed transfer system, with multiple transfer points and coordinated schedules	Transit dependents, Military families, Travelers to non-CBD destinations
• Community-based para-transit, Travelers to non-CBD destinations	Low-density areas
• Extend-a-ride fare (transfer)	Trip chaining
• Tours of local sights and other tourist-oriented services (e.g., ferry service)	Area visitors
• Comprehensive ridesharing services	Commuters
• "Product Manager" model of marketing	

REASONS FOR HIGH PRODUCTIVITY

- Revised fixed-route network to accommodate timed transfers
- Many fare/pricing innovations
- Expansion of service on express bus routes

SYSTEM PROFILE

Tidewater Regional Transit (TRT) provides regular-route transit to the cities of Chesapeake, Norfolk, Portsmouth, Suffolk, and Virginia Beach. The urbanized area is 253 sq mi with a population of 900,000. The area is influenced by the U.S. Navy, such that the transit system lost approximately 50,000 riders during Operation Desert Storm as both military personnel and their dependents left the area.

TRT operates a fleet of vehicles that is a mix of traditional heavy-duty buses, raised-roof paratransit vans, passenger vans, rubber-tired trolley replica buses, and ferry vessels. TRT categorizes its service as three distinct service groups: transit and paratransit; tourist (summer); and ridesharing.

TRT is known within the transit industry for its innovations. It was one of the first systems to introduce paratransit service, community-based service for the general public, and ridesharing and vanpooling. TRT also has many innovative elements in its fare structure, as a way of segmenting its markets. Examples include deep discount pricing, the Fare Cutter Card, and the Extend-a-Ride transfer.

RIDER PROFILE (US Census Data 1990)

In FY 1994, TRT carried 8.3 million passengers, of which 6.9 million were on its bus services. The others used the other five services: Maxi Ride, trolley, ferry, Handi-Ride, and vans.

Productivity in FY 1994 on the bus service averaged 18.6 passengers per hour. The productivity of TRT's Maxi Ride service was 3.5 passengers per hour. The trolleys carried 17.3 passengers per hour, while the higher capacity ferries carried 79.5 passengers per hour.

TRT bus ridership over the past 10 years has declined. Its passenger productivity for fixed-route bus service has shown a similar decline. Recently, year-to-year trends have been more stable.

The largest recent change in bus ridership on regular-route transit services occurred between FY90 and FY91. Annual bus ridership decreased from 8,540,179 in FY90 to 7,443,829 in FY91. This was largely the result of Operation Desert Storm, which took military personnel and dependents from the area. Ridership continued to decline, to 7,059,517 in FY92 and 6,880,249 in FY93. In FY94 ridership increased slightly, to 6,882,577. As shown below, the recent ridership trends for the other services were mixed.

Annual Riders

Service	FY93	FY94	Percent Change
Bus	6,880,249	6,882,577	0.03
Elderly and handicapped	161,453	178,971	10.85
Maxi-Ride	78,372	79,655	1.64
Trolley	728,026	610,796	-16.10
Ferry	485,123	481,492	-0.75

The trolley and ferry serve the tourist market, which was affected by heavy rainfall during July and August 1994 (over 14 inches fell on the Hampton Roads area).

SERVICE CHANGES THAT AFFECT PRODUCTIVITY

In anticipation of declining subsidies, TRT has had to reduce service over the last decade; however, a considerable effort has been made in trying to get the most out of each bus on each route. Because transit operates for the benefit of passengers, it is very desirable to combine efficient route design with a network design. Timed transfers have served both as an operating system and a customer service approach.

TRT introduced a timed transfer system in multiple phases, from 1989 through 1991. All routes and schedules were revised from a radial network to a system of multiple hubs and spokes. Schedules promote coordinated transferring. There are 13 transfer locations in the service area. From two to six routes meet at a location. There are no elaborate facilities because passengers are not waiting long (off one bus and onto the next). As part of a guaranteed connection program, drivers may wait up to an extra 2 min beyond scheduled leave time for other buses due at the transfer point.

TRT's Direct Transfer Bus system is popular with riders and the essential thrust of its service delivery network. About

40 to 45 percent of bus trips involve a transfer. More than half of all transfers occur outside the downtown area.

TRT eliminated the dispatch function on Maxi-Ride, its community-based paratransit services. Services operate within a small area (25 sq mi). There is only one vehicle per area. The vehicle is equipped with a cellular phone. Passengers call the driver directly to request a pick-up. The driver develops the most appropriate route and schedule to accommodate the requests.

The Summer Youth Pass has given TRT a vehicle for marketing to the next generation of bus riders and commuters while marketing the direct transfer benefits to their parents.

TRT's emphasis of late has been on increasing ridership of the HOV Express Buses. TRT has had success marketing the HOV concept, as evidenced by the 6,000 vehicles per day using them to commute and the 700 people who have signed up for the Guaranteed Ride Home Program.

MONITORING PRACTICES

TRT has good route-level statistics in its monthly performance report. It gets fare category information from the farebox. More detail on segments comes from specific market research efforts.

TRT does periodic market research. Typically, its research is small scale and project-specific. Most research is conducted after a change has been implemented and is part of the evaluation.

An example of a more comprehensive survey was one conducted in December 1991 to determine a profile of the transit riders, identify transit origins and destinations, determine trip purpose, and identify potential improvements to the TRT system. This particular survey was conducted of 3,361 riders on all regular weekday bus routes. Similarly, a survey was conducted of residents as part of the Short Range Transit Development Program, completed in July 1993, to better understand their attitudes toward transportation issues, their awareness and perception of TRT services, and their potential for making more use of existing and future local public transportation services. A total of 1,200 telephone interviews were conducted. An on-board survey also was conducted as part of this effort.

FARE STRUCTURE AND PASS PROGRAM

TRT achieved a farebox recovery rate of 46 percent in FY95.

There have been no fare changes since 1990. TRT's pricing consists of cash fares, discount ticket books, and Fare Cutter cards. Other pricing categories include additional zones, Extend-a-Ride, express surcharge, and reduced fares for senior citizens, persons with disabilities, and children. The current base cash fare is $1.10. An additional $0.55 charge is required when crossing a zone. There is an express surcharge of $0.10 and an HOV Express fare of $1.50. TRT offers half fares to senior citizens, persons with disabilities, and children. Consistent with its timed transfer system, there is no charge for transfers. The Extend-A-Ride fare, which permits the passenger to get on and off the same bus route, is priced at $0.55.

Ticket discounts are the core of TRT's fare strategy. Tickets are sold for $0.80 each, reflecting a significant discount off the cash fare. Reduced-fare tickets also are sold. TRT also sells two Fare Cutter Cards. A passenger who purchases this monthly card pays only $0.25 per boarding. A one-zone card is sold for $20.00 and an all-zone card is $38.00.

The current cash fare for Maxi-Ride and Handi-Ride is $2.20. Maxi-Ride users can pay with tickets, using two bus tickets or $1.60. Handi-Ride users can use a zone ticket for $1.10. Other special fares are in effect for the ferry, seasonal trolleys, tours, and festival shuttles.

A fare restructuring was to be implemented on November 5, 1995. Zone fares will be discontinued, reflecting TRT's conclusion that distance is not an appropriate market. The emphasis instead will be on discounts, distinguishing markets by their sensitivity to discounts and their willingness to pay. The cash fare will be a flat rate of $1.50. Discount tickets will be sold in a book of ten for $10.00. TRT will keep the Fare Cutter Card, pricing it at $32.00 plus $0.25 per ride. The HOV Express Bus fare and the express surcharge are being discontinued. Maxi-Ride and Handi-Ride both will become a flat rate of $3.00 (twice the base fare). Transfers will remain free under the fare restructuring. The Extend-A-Ride ticket will become $0.75.

ROUTE-SPECIFIC INFORMATION AS AN INDICATOR OF GROWTH TRENDS

During the period from October 1994 through June 1995, the entire TRT bus system averaged a productivity level of 22.3 passengers per hour. The performance of individual services was as follows:

Service Type	Passengers per hour
Fixed-route	19.3
Maxi-Ride	3.8
Handi-Ride	0.2
"Visitor"	19.4
Ferry	68.8

Cross-town routes have proven to be a growing market; ridership has increased even more with timed transfers. The timed transfer system is more suitable to the geographic pattern.

Routing has been refined on the express services (HOV and park-and-ride). From October 1994 through June 1995, productivity on the five express routes was 11.6 passengers

per hour. However, productivity on Route 40N Park-and-Ride was 40.3 passengers per hour.

In addition to the naval base routes, TRT has added HOV express bus routes to downtown Norfolk and to the medical center in Norfolk. TRT also is working with PenTran, the transit operator for the Hampton/Newport News area regarding improvements to interregional express bus service.

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NEW SERVICE CONCEPTS	TARGET MARKETS/ USER GROUPS
• Cross-Town Routes (Color Lines)	Workers at Major Employment Centers, Residents of North Phoenix
• DASH	Downtown Workers
• Dial-A- Ride	General Public on Sundays and Holidays
• Bike and Ride Program	Students
• Magnetically Coded Fare Collection Boxes	All Riders

REASONS FOR HIGH PRODUCTIVITY

- Rapid population growth
- Increase in service miles
- Creation of regional public transportation authority
- Route restructuring (cross-town routes)
- Bike and ride program

SYSTEM PROFILE

In 1986, with the creation of the Regional Public Transportation Authority (RPTA) in Phoenix, bus service increased by more than two million miles. Despite that increase, Phoenix Transit operates on a grid system which leaves segments of its service area, including major employment centers, unserved. With the exception of two route extensions and several cross-town routes (Color Lines) in the northernmost edge of Phoenix, there has been very little new service added since 1990. Because there are multiple contractors providing bus service in the Phoenix area, there is some duplication of service.

RIDER PROFILE (US Census Data 1990)

• 1.98 percent	Total Transit Use
• 53 percent	Female
• 18 percent	Immigrants
• 12 percent	Black
• 28.54 percent	Hispanic
• 64 percent	Single

The profile of Phoenix area bus riders differs from the national average in two respects: nationally, seniors account for 7 percent of bus riders, in Phoenix, only 3 percent are over age 65, while 18 and under riders account for 17 percent of the Phoenix ridership, which is significantly higher than the national average of 10 percent.

SERVICE CHANGES THAT AFFECT PRODUCTIVITY

- Workers at Major Employment Centers—Color Lines

  RPTA responded to the constraints of the grid system and piece-meal approach to service delivery with route restructuring in the East Valley. In March 1994, they introduced Color Line Service designed to serve major employment centers and other major destination points such as Arizona State University and Sky Harbor Airport.

  New routes were created by taking the most productive segments of existing routes and realigning them along transportation corridors. The lines were linked together and headways reduced by 15 to 20 min. The Color Lines do not operate on a grid—they follow natural geographic boundaries. Riders who previously had to transfer can now make a "one-seat trip." While ridership has increased on the Color Lines, there has been a corresponding decline on the grid-line routes.
- Downtown Workers—Downtown Area Shuttle (DASH)

  A free downtown circulator was introduced in Phoenix in November 1990. It was sponsored by a partnership of the downtown merchants and financed with an Air Quality Management grant. It operated on a 10 min loop through downtown and provided service to the state capital. During the first couple of years, growth was high and ridership peaked at 650,000 passengers a year.

  In July 1992, funding ended and a $0.25 fare was initiated. There were also concerns from the downtown merchants that there were a significant number of homeless using the shuttle. The circulator route passed by several

downtown homeless shelters. With the addition of the fare, ridership declined. As ridership declined, service was cut back. In March 1995, there were additional service reductions and the shuttle now provides service to the capital only during lunch hours. Ridership has declined from a high of 1,500 riders a day, to less than 600 a day. Seventy percent of current users are lunchtime riders.

There is no indication that DASH riders are typical public transit riders. RPTA never attempted to determine if the introduction of DASH provided an incentive for increased overall transit ridership into the downtown area. It is assumed that it did not, since riders do not fit the typical transit profile. Because of ridership declines, service will most likely be discontinued soon.

- Seniors and Disabled, General Public on Sundays and Holidays—Dial-A-Ride

  Prior to March 1993, Phoenix Transit offered a weekday general public Dial-A-Ride in the north end of Phoenix where fixed-route service was limited at best or non-existent. Through a contract with the Arnett Cab Company, mini-vans provided service in the 130 sq mi area that was sparsely populated. Because fixed-route service has been added to that area with route extensions and several new cross-town routes, the weekday general public Dial-a-Ride has been discontinued.

  Because there is no fixed-route service in the Phoenix area on Sundays and some designated holidays, Dial-A-Ride service is available to the general public on those days. In recent years, Phoenix Transit purchased accessible vans using federal funds. These vans are now being used by Arnett Transportation to operate the Dial-A-Ride program.

  The base fare for the general public is $2.40 with a surcharge of $1.20 for each additional zone. There are nine zones in the service area. The average trip is two or more zones, so the average fare is $3.60 or more.

  About one-quarter of the 475 riders on Sundays are general public riders who typically travel to transfer points where they connect with one of the other seven Dial-A-Ride programs in the Valley. The eight Dial-A-Ride programs do not cross jurisdictional boundaries, so a passenger may wait as much as 2 hr at a transfer point to switch to a different carrier.

- Students

  Bicycle Racks

  Phoenix Transit is the first transit agency to equip its entire fleet with bicycle racks that can accommodate two bicycles per bus and has installed bicycle lockers at many frequently used cyclist destinations. The cost for the project was $80,000. No performance tests have been conducted to determine if this project generated any new bus riders, but management considers the project to be a successful part of its attempt to attract "environmentally conscious" riders.

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NEW SERVICE CONCEPTS	TARGET MARKETS/ USER GROUPS
• The Link/STV Feeder Routes	East End Residents (discontinued)
• THREE for FREE	CBD Workers, Shoppers, and Tourists
• Summer Ride	Teenage Riders/School Age Children
• Passport to Adventure	Summer Riders, Children, and Parents
• Contract with University of Pittsburgh	Students, Faculty, and Staff

REASONS FOR HIGH PRODUCTIVITY

- Service cuts (6.8 percent of service eliminated)
- HP Flyer express routes
- Route deviation to traffic generators
- STVs on non-productive routes
- Fare increases
- High percent senior riders

FACTORS THAT INHIBIT THE GROWTH OF TRANSIT

- Lack of reverse-commute service
- Abundant fringe parking with free shuttle service to CBD
- Light rail ridership at capacity

SYSTEM PROFILE

Pittsburgh has a traditional radial system with 50 percent of riders still traveling into the CBD. The population of the city of Pittsburgh has declined from more than 300,000 to less than 250,000, while the surrounding counties continue to grow. PAT has been unable to keep pace with the growth. New service cannot be added without corresponding reductions in existing service. The growing market is a reverse-commute market.

RIDER PROFILE (US Census Data 1990)

- 8.87 percent Total Transit Use
- 63 percent Female
- 3 percent Immigrants
- 25.2 percent Black
- 62 percent Single

SERVICE CHANGES THAT AFFECT PRODUCTIVITY

- The Link

  This project was initiated in November 1990 as a year long demonstration to test the viability of small transit vehicles in older neighborhoods. Twenty-four passenger vehicles were substituted on 6 non-productive routes, which fed into main trunk lines at two transfer points. Although frequency was reduced to hour headways, the demonstration was successful, and ridership doubled.
- Three for Free

  Within the CBD, and for all trips originating in the downtown area, riders travel fare free on bus and light rail. There is barrier-free entry at all three rail stations in the CBD (three stops for free) allowing for free travel from one downtown destination to another and on all buses boarded in downtown Pittsburgh. This service is well utilized by those working and shopping in downtown and has been a great selling point for the convention and tourist trade. Trains operate at capacity.
- Passport to Adventure

  This program provides free rides in the summer to children 11 and under when accompanied by an adult. The passport also provides free admission to local cultural and recreational attractions when the child is accompanied by an adult paying full-price admission.
- Summer Ride

  A program designed to enable inner-city teenagers to get summer jobs and keep them by providing a bus pass for children 18 and under, at a cost of $45. The pass looks like a drivers license, with a photo ID, and is valid from June 1 through August 31 in all 5 zones with no restrictions. It can be used to travel to summer day camps, as well as other recreational activities. Pass holders are entitled to discounts at retail stores, bowling alleys, and so forth.

  The City of Pittsburgh also purchases the Summer Ride Pass for summer school students. The target market for this program was teenage riders—in fact, most riders are 8- and 9-yr-olds. During the first year of the program, PAT estimates that there were 95,000 trips; by last year, the number had risen to 225,000, with an expectation of an increase this summer.
- Special Events
  1. PAT successfully provides shuttles for Steelers Games, Pirates Games, and University of Pittsburgh events at a special round trip fare of $2.50.
  2. For the USGA Open at Oakmont Country Club, PAT was able to provide no-fare express service using special access ramps. During a week-long period, PAT provided service for 105,000 spectators under a $100,000 contract. Eighty percent of the riders for that event had never ridden the bus before.
  3. To celebrate the 100th year anniversary of Carnegie-Mellon Institute, PAT provided 24-hr, round-the-clock shuttles connecting four locations participating in the celebration.
- Contract with University of Pittsburgh

  PAT has arranged to provide service from two neighborhoods onto campus for a lump sum payment of $4,000 a week. The University is the largest employer in the area, and on-campus parking is scarce and expensive. A University ID card is used as a bus pass. This experiment expires next spring, but PAT hopes that it will be successful and can be expanded to other campuses as well.

MONITORING PROCESS

Ridership is monitored on a trip-by-trip basis, using eight checkers who ride the buses. Public meetings are held to get input from the community.

PASS AND FARE STRUCTURE

Fifty percent of riders use some sort of prepaid instrument. Tickets are sold in books of 10 and are priced according to zone. There are annual passes and 6-month passes. Purchasers of annual passes pay for 10 months of service and receive 2 months free. Purchasers of 6-month passes get 1 month free. PAT operates on a zone system with the cost of annual passes ranging from $400 to $1,130. There is a surcharge for light rail trips, and a surcharge on cash fares paid during peak hours. Six companies participate in the Transit Check Program, in which employers purchase a transportation voucher in denominations of $15 to $60 for distributing to employees as a benefit. The employer, in return, receives a tax break.

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NEW SERVICE CONCEPTS	TARGET MARKETS/ USER GROUPS
• Express Service from Park-and-Ride	Suburban Commuters Lots
• Summer Ride and Read Program	Middle School Students
• Development of Service Routes	Low-income Workers

REASONS FOR HIGH PRODUCTIVITY

- Compact service area
- Elimination of unproductive routes and Sunday service
- Reduction in frequency of service
- Well-established monitoring practices
- 71 percent captive riders

FACTORS THAT INHIBIT GROWTH OF MASS TRANSIT

- State regulations prohibiting expansion of transit service
- Negative population growth
- Demise of downtown commercial district
- Surplus of inexpensive and accessible parking
- Excellent road system providing quick and easy access to CBD

SYSTEM PROFILE

GRTC has a compact service area essentially defined by the Richmond city limits. Service is provided through a radial route system that extends to the county boundaries and in a few instances beyond.

Despite a declining population base in the city (from 230,000 to 203,000) and a corresponding decline in ridership, GRTC has maintained good productivity rates. Unlike most other urban transit providers, it was not burdened by a surplus of service introduced prior to 1990. When the city assumed control of GRTC 20 years ago, unproductive routes were cut back.

Although Richmond has historically been a good transit town (a public transit system has been in place since the late 1850s), ridership has declined steadily in recent years. Beginning in 1991, passenger trips dropped dramatically with an average decline of 9.4 percent. By 1993, ridership was down an additional 11.1 percent.

Suburbanization of the surrounding counties has occurred. Transportation services have been unable to follow. In the Commonwealth of Virginia, transit companies cannot provide service to adjoining jurisdictions without their approval. GRTC provides limited service to Henrico County in the west end of Richmond, but no service to Chesterfield County where most of the growth has occurred in the last 15 years.

RIDER PROFILE (US Census Data 1990)

GRTC's typical rider is employed (80 percent), a transit rider for more than 5 years (58 percent), a female between the ages of 18 and 44 (67 percent), a resident of a household with a total income of less than $20,000 (60 percent), and does not have a vehicle available to make the trip (71 percent).

SERVICE CHANGES THAT AFFECT PRODUCTIVITY

- Disabled and Elderly
  1. By providing maps and schedules through social service agencies and retirement homes, senior and disabled riders are encouraged to use the public transit system rather than paratransit.
  2. Since 1982, GRTC has been buying accessible buses. During peak hours, the fleet is 80 percent accessible, and during off peak hours there is 100 percent accessibility. By 1996 there will be 100 percent accessibility during peak hours. Disabled riders account for 3,600 trips per year out of a total of 9 million.
  3. Paratransit services are provided under contract with a private operator—roughly 140,000 trips per year. Fare is $2.25 and no passenger has a ride time of more than 1 hr, with most trips under 45 min.
- Downtown Workers and Tourists

  From early 1993 to July 1994, GRTC ran a fare-free downtown trolley from 11 AM to 2:30 PM. It carried 250,000 passengers per year. In July 1994, a $0.25 fare was imposed. Ridership dropped in half. The frequency was cut from 6 min to 12 which led to the loss of the lunchtime crowd. Service ended July 1, 1995.
- Commuters

  GRTC has attempted to increase ridership on park-and-ride routes by encouraging employer subsidies. Bus fares are subsidized for the first 90 days of employment, but once the subsidy ends, ridership drops and few riders are retained.
- Service Workers

  In an effort to expand service for low-income workers, GRTC developed a route known as the Jobs Bus which travels along the corridor where many service-sector employers are located. The intent was to enable hotel and restaurant workers to travel to their place of employment.
- Students
  1. The Read and Ride Program was developed in cooperation with the school system and the public libraries. It was designed to encourage students to use the bus and read during the summer. Free bus tickets are awarded to the participants—one ticket for every four books read. The program was introduced in 1992 with 30 students and by last summer had grown to 200 participants.

2. The city of Richmond is entering into a partnership with Virginia Commonwealth University and the state to encourage development of a biotechnical research triangle. GRTC is involved in this project to the extent that it is developing a new transit corridor. This would enable them to provide service with a circulator shuttle that would travel between the university, the research triangle area, and the state offices.

- Newcomers

  Through local real estate agents, GRTC provides a welcoming package to new residents which includes maps and six free bus tickets. This program has had very limited success in generating new riders.

- Special Events

  GRTC does not provide any service for special events. Even when Richmond hosts the NCAA finals, ample parking in the coliseum area is available.

MONITORING PRACTICES

GRTC monitors two-thirds of the 48 routes in its system each year and compares that data with the previous year. They systematically check the first 32 routes 1 year, then the last 16 and first 16 the following year. A system-wide average is computed for effectiveness (passengers per hour) and efficiency (revenue). Each route is measured and graded against the system averages, and recommendations for service cuts are based on the grades. They use this process to monitor changes in ridership and locate unserved residential or employment sites.

Within the traditional service area, there have been no significant changes in ridership patterns in the last 20 years. Ridership continues to be distributed evenly throughout the system, and the decline in ridership is also spread evenly. Twenty years ago, 20 percent of the riders transferred, today 20 percent of the riders still transfer. The marketing department conducts on-board surveys once a year. Riders always want an increase in frequency of service.

FARE STRUCTURE AND PASS PROGRAM

1. The Pass Program was eliminated in 1991 on the advice of a consultant. Prior to 1991, there was a weekly pass that was freely transferable, with no picture ID required. This program generated lots of riders but no revenue.
2. Since 1990, GRTC has raised fares four times, including twice in 1993. The fare structure includes a cash fare and a discounted fare purchased in books of 10 tickets. Transfer fees vary depending on the method of payment. Riders with disabilities, senior citizens, and school children ride for half fare.
3. Henrico County uses zone fares. The additional charges for service to the county range from $0.15 to $0.45. Fares on each route are based on distance, but the system is so complicated that frequently operators on the same line are charging different fares for the same service.

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NEW SERVICE CONCEPTS	TARGET MARKETS/ USER GROUPS
• New Rail Stations	Commuters, Faculty, Staff, and Patients at UCMC
• Route Restructuring	Commuters
• Shuttles from Light Rail Stations	Employees in Developing Industrial Area
• Office and Commercial Development at Light Rail Stations (Planned)	Light Rail Patrons

REASONS FOR HIGH PRODUCTIVITY

- Growth in light rail system (3.1 percent per month 1994–1995)
- Route restructuring in southern sector in 1994
- Reduced travel time (1 percent reduction increased ridership by 1.8 percent)
- Shuttles from light rail stations to employment centers
- Timed transfer between bus and rail system
- Fare increase in 1992
- Elimination of non-productive routes (replaced with through routes that combined most productive segments)

SYSTEM PROFILE

Sacramento, an urbanized area with a population slightly in excess of 1 million people, is the state capital of California. The Sacramento Regional Transit District (RT) has a service area of 295 sq mi and provides both light rail service and local and express bus service.

In April of 1987, Sacramento expanded its service with a light rail system that became fully operational on two segments in 1988. Ridership increased from 16.7 million trips in FY89 to 21 million trips in FY93. Since 1993, ridership on light rail has increased at the expense of ridership on the bus system. During the last year, light rail ridership has been increasing at the rate of 3.1 percent per month while rider-

ship on the bus system has decreased by 2 percent. This was preceded by a slight reduction in bus service in 1992.

The system is organized to provide timed transfers between modes, and there has been substitution between modes on some routes. The first parallel bus route was introduced in August 1995. It provides express service during peak hours with a travel time of 15 min less than light rail.

State employees working in the CBD provide the primary transit market. Sacramento is home to California State University, as well as several junior colleges and a large community college. CSUS students account for 3 percent of the total transit market, and university students as a whole, for 7 percent.

RIDER PROFILE (US Census Data 1990)

- 2.38 percent — Total Transit Use
- 54 percent — Female (bus)
- 64 percent — Female (subway)
- 71 percent — Female (L.R.)
- 13 percent — Immigrants
- 14.6 percent — Black
- 62 percent — Single

SERVICE CHANGES THAT AFFECT PRODUCTIVITY

- Commuters

  Route Restructuring

  In 1994, RT reoriented and restructured service in the South Sector to better serve that market. Non-productive service was replaced with through routes that took the most productive segments of existing routes and combined them. Arterial streets with heavy commercial traffic that had previously not been linked together were combined into through routes with more frequent service to major attractions.

  Routes that did not meet performance standards were abandoned or served less frequently. A major shopping mall serves as a transit center for a number of these routes. This south area restructuring has started to generate new ridership. Ridership in June 1995 was 12 percent higher than June 1994 on the restructured routes. Management hopes to see this level of growth from this point forward.

  Parallel Routes

  In the summer of 1995, the first parallel bus service was introduced on the Orange Vail Citrus Heights Route. There are two trips a day, one in the morning and one in the afternoon. It is considered a premium service, and the fare is $2.00 each way. Travel time is 15 min faster than the comparable light rail route. If the service is successful, management will consider adding additional parallel routes. RT patrons are requesting the service.

  New Rail Stations

  Two new light rail stations were added to the Folsum Line at 39th and 48th Streets at a cost of $600,000 each. The purpose of the expansion was to increase the level of utilization of existing service. These stations are in high- and middle-income residential neighborhoods. The new stations are more elaborate and were designed with input from the neighborhood residents.

  Before these sites were completed, the nearest stations were located 30 blocks away. Ridership increased significantly, attracting some new riders, but there was a corresponding decrease on the bus line that served this area. The 39th Street Station is on the northern fringe of the UC Medical Center and there is new hospital construction in the area as well. The station includes a turnaround for the free shuttle bus that serves the medical center.

  Shuttle Loop

  RT created a new shuttle route to serve a developing industrial area in the south. The old army depot is being converted to private use. The shuttle connects the light rail station to a major computer assembly plant which employs several thousand workers.

- Students

  Although the University operates its own on-campus shuttle, RT provides additional service to Cal State students with a number of routes between light rail stations and an on-campus terminal, through the campus with a circulator, and off campus to nearby apartment complexes.

  Since the introduction of a special student pass which allows the holder of student ID cards to ride for "free," ridership in this market has increased by 300 percent. CSUS students, however, account for only 7 percent of total RT ridership. The Student Association pays a portion of semester fees to cover the cost of the pass. RT also provides service to several junior colleges and a large community college.

- Special Events

  The Sacramento Jazz Jubilee Festival, an annual event, takes place on the 4 days of Memorial Day weekend. RT operates free shuttle buses paid for by the private non-profit corporation that sponsors the festival. Additional trains, increased frequency, and later service are added on light rail to accommodate the 30,000 additional riders that the festival generates.

  In 1991, there was a surge in ridership that can be explained by two special events: the Railfair and the Sacramento Jazz Jubilee Festival.

FARE STRUCTURE AND PASS POLICY

The base and peak fare for both the bus system and the light rail system is $1.25. Transfers are free and are valid for 90 min. Fifty percent of RT riders pay the fare in cash.

Forty percent of bus passengers and 37 percent of light rail patrons pay the full cash fare; the remaining cash riders, such as seniors, disabled, and youth riders, pay a discounted cash fare. There are ticket books available at a 10 percent discount at 60 RT sales outlets.

The proportion of riders that use passes is 50 percent. The monthly pass is $45, with some employers paying a portion of the monthly pass cost. There is a special student pass used by Cal State University students. This pass is paid for with student activity fees and allows students with valid picture IDs to ride for "free." Most students using this pass travel at off-peak hours. The county Department of Welfare purchases passes from RT for eligible clients to facilitate travel to social service agencies dispersed throughout the area.

There was a fare increase in 1992 at the time the fare plan was simplified. RT resists imposing fare increases until a $0.25 increase is required. Management has adopted a policy of keeping the fare structure easy to understand.

MONITORING PRACTICES

RT employs retired professionals to audit their service annually. On-board surveys are conducted every few years. On-time performance is monitored and used as a basis for schedule adjustment. Service that is 10 min late is registered as a missed trip and another vehicle is inserted if available. Passenger service reports with both complaints and commendations are written up and turned over to management. Census data and the 1989 on-board survey were used for route restructuring.

ROUTE-SPECIFIC INFORMATION AS AN INDICATOR OF GROWTH

RT computes a composite rank for each route based on passengers per day, per revenue hour, per mile, and so forth. The route that has experienced the most growth is Route #88. This route travels from downtown, out the interstate to South Natomas (highest density area outside the CBD; low-income single-family and multifamily residential) to the Arden\Del Paso light rail station. This route carries 1,200 passengers a day, with a 41.5 PRH average (compared with a system average of 31 PRH) and has a fare box recovery of 31.3 percent which is 50 percent higher than the 23.2 percent average systemwide.

The second most successful route is #87, which travels from downtown to the northern part of South Natomas, which is even lower income. This route makes a big loop, from the light rail station at UC Medical Center through an active commercial strip, past the university and terminates at a large community college. This route has a PRH of 36.

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NEW SERVICE CONCEPTS	TARGET MARKETS/ USER GROUPS
• Expanded Park-and-ride System	Suburban Commuters
• Route Restructuring and Extensions	University Students, Shoppers
• Suburban Circulators	Apartment Complexes
• Downtown Circulator	Tourists

REASONS FOR HIGH PRODUCTIVITY

- Route restructuring
- Elimination of unproductive segments (26 percent cutback in October 1995)
- Expanded headways
- Fare increase (100 percent)
- High percent captive riders (75 percent)
- Large university population

FACTORS THAT INHIBIT GROWTH OF MASS TRANSIT

- Lack of CBD employment and commercial district

SYSTEM PROFILE

San Antonio had one of the most productive transit systems in the country and in 1989 was voted best transit agency by APTA. In 1990, VIA was carrying 42,000 passengers a day and had a passenger per hour rate of 38.

RIDER PROFILE (US Census Data 1990)

• 3.91 percent	Total Transit Use
• 55 percent	Female
• 20 percent	Immigrants
• 14 percent	Black
• 69.34 percent	Hispanic
• 66 percent	Single

San Antonio has a high percentage of low-income captive riders, (30 percent have a household income less than $10,000) living in scattered-site Section #8 housing, with no

automobile available. There is also a high percentage of university students who use public transportation to reach the campus, where parking is a problem, and for shopping and recreational purposes.

SERVICES CHANGES THAT AFFECT PRODUCTIVITY

- Commuters
  Park-and-Ride
  San Antonio has developed an extensive park-and-ride system fed by a combination of local, cross-town, and circulator routes. The park-and-ride system is designed to resemble a wheel and spokes with an inner loop 8 mi out and an outer loop 16 mi out at the expressway. There are 26 bus routes that lead from the park-and-rides into the main terminal.
- Tourists
  Downtown Loop
  San Antonio has several downtown streetcar routes that circulate within the CBD. The streetcars make a one-directional 30-min loop, targeting the tourist market by passing in front of hotels and the Alamo.
  Originally the service was free, then a $0.10 fare was added. Last year, the cost increased to $0.25 and has since been raised to $0.50. Seventy percent of the ridership is the tourist market. When the service was free, there were 12,000 riders a day. That has declined to 8,000 riders daily.
- Suburban Market
  Apartment Complex Circulators
  San Antonio decided to develop routes that targeted numerous suburban apartment complexes that had no previous service. Single routes were paired together providing service to 35 apartment complexes with more than 8,000 apartments. The largest complex has more than 1,000 apartments.
  The average trip length on these circulator routes is less than 3 mi and buses run every 30 min during peak hours and once an hour off-peak. The routes run between the University of Texas and the apartment complexes and pass the Medical Center and several telemarketing firms where students are employed part-time, and ultimately feed into a terminal with 11 CBD and cross-town routes.
- Special Events
  Special events service is provided annually for several festivals from park-and-ride lots into downtown at an average cost of $5. In April, Fiesta Week with parades, food booths, concerts, and so forth, draws a ridership of 86,000. In August, over a long weekend, there is the Texas Folklife Festival, where there is also no parking available, and that 4-day event gets a ridership of 54,000.

MONITORING PRACTICES

Random monitoring is conducted using on-board surveys to develop ridership profiles used by the market research department.

FARE STRUCTURE AND PASS PROGRAM

On October 1 there was a fare increase which raised the base fare from $0.40 to $0.75 and the express fare from $0.75 to $1.25. A $0.10 transfer fee was also added. A 20 percent decline in ridership is expected in response to this increase, but there has not been sufficient time to evaluate the effect.

Pass usage had been at about 9 percent to 10 percent but is expected to jump to about 30 percent in response to the fare increase. The 25 percent of riders who were transfers are expected to become pass users in order to avoid the transfer fee. There is a monthly pass valid for 40 rides which is subject to much abuse. More than one person can use the same pass, and many riders share passes. There is a half fare pass for students, the elderly, and riders with disabilities; and school districts provide passes for those students who live outside the 2-mi radius.

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NEW SERVICE CONCEPTS	TARGET MARKETS/ USER GROUPS
• Bus Tunnel and Breda Buses	All Passengers Traveling through Downtown
• LINC (Pilot Project)	Ballard Residents
• U-PASS	University of Washington Students, Faculty, and Staff
• STV Feeder Routes	Underserved Suburban Communities
• Free Ride in Downtown	Downtown Workers, Shoppers, and Tourists
• Late Night Stops on Demand	Late Night Riders Concerned With Security
• All-Day Tourist Pass	Weekend Tourists
• Seasonal Schedule Adjustments	University of Washington, Tourist Market
• Customized Shuttle Routes	Suburban Employment Sites, Private Schools

REASONS FOR HIGH PRODUCTIVITY

- Bus tunnel (reduced travel time through downtown)
- Reallocation and consolidation of existing service

- Electric trolley routes (short routes through highest density neighborhoods)
- U-PASS at University of Washington (37,000 students, second major transit market)
- Use of smaller transit vehicles on circulator and new feeder routes
- Development of new suburban van routes (suburb to suburb)

SYSTEM PROFILE

METRO's service area includes all of King County and is largely a 1970s radial system with peak emphasis. Management is proposing a 6-year plan that would restructure service to accommodate changing travel patterns. There is an increase in multipurpose trips and trips to employment sites in the suburbs, both of which shift ridership away from peak-hour concentration.

Because of trip-chaining, more flexible service is required. They propose to offer better service with fewer coaches and fewer fixed routes, with increased emphasis on feeder service at the tails of main trunk lines.

RIDER PROFILE (US Census Data 1990)

- 7.18 percent Total Transit Use
- 55 percent Female
- 12.6 percent Immigrants
- 10.10 percent Black
- 63 percent Single

SERVICE CHANGES THAT AFFECT PRODUCTIVITY

- Bus Tunnel and Breda Buses

  METRO opened a new 1.5-mi-long bus tunnel, with five stations, in September 1990. There was no route restructuring for the tunnel project, just selected routes that would benefit from reduced travel time. Several new routes were added successfully.

  In conjunction with the tunnel opening, the fleet was converted to Breda Buses, 60-ft dual-powered articulated vehicles that operate on electric power in the tunnel and diesel power outside of the tunnel. The plan is that the tunnel could be converted to light rail later on. At the same time, I-90 was completed which also reduced travel time.
- LINC (Local Initiative Neighborhood Circulator)

  LINC was developed as a 9-month demonstration project to be funded with federal grants. The project was designed to experiment with small vans, free fares, and circulator routes in outlying suburban communities.

  Four circulator routes were developed to provide all-day flexible service to neighborhood centers and park-and-ride lots, connecting at several transfer points with large-capacity buses that travel by freeway to downtown. Although successful, the project is currently not affordable and will soon be discontinued.
- U-PASS

  METRO developed a partnership with the University of Washington (UW) in 1992. With 37,000 students, the university is the second major transit market in Seattle. As such, UW decided to invest in transit by subsidizing additional service. All students, faculty, and staff are entitled to a U-PASS which is attached to the back of the UW ID card. The cost of the pass is included in tuition charges. As part of the program, the cost of on-campus parking was raised significantly. At the same time, the Seattle Bus Tunnel was opened, reducing travel time. New routes were added and frequency on existing routes was increased from 30-min headways to 15 min. Ridership stayed constant on these routes despite the increased frequency, so actually total ridership doubled.
- Special Events

  Included in the purchase price of season tickets for athletic events at UW is a Transit Ticket that entitles the holder to free shuttle service to the stadium. UW pays 100 percent of the cost for this service.
- Free Ride Downtown

  All transit riders traveling within the downtown area, including the tunnel, ride free until 7 PM. Riders coming from outside downtown pay a fare upon boarding; riders leaving downtown pay when debarking. Originally, designed to reduce dwell time, the free ride concept has been modified. Riders traveling within the downtown after 7 PM are now required to pay the fare. This was done to minimize the problem of vagrants riding for free all night.
- Experimental Night Security Program

  METRO is testing a concept in which passengers riding at night are allowed to request a stop at any location along the route, not just at officially designated bus stops. This concept has been developed to enhance customer security.
- New Small Vehicle Shuttle Routes

  METRO is encouraging the use of 16-passenger shuttles for all-day low-frequency circulator routes in low-density remote suburbs. These routes connect suburban communities to each other and to otherwise unserved employment sites.

FARE STRUCTURE AND PASS PROGRAM

Seattle operates with a simple two-zone fare. The city is zone #1, the rest of the county, zone #2. There is no additional charge for premium service—local and express service cost the same. There is a higher charge for travel during peak hours. Fares range from $0.85 off peak to $1.60 for zone #2 during peak hours. Passes are coded with electromagnetic stripes; this reduces dwell time and facilitates data collection on travel patterns and ridership.

MONITORING PRACTICES

METRO uses two types of monitoring. Several years ago, the fleet was equipped with Automatic Passenger Counters (APCs) and Automatic Vehicle Locators. The APCs are attached to fare boxes and odometers and collect data on loadings and lightings at every stop. Human monitors confirm that the APCs are working correctly. The APCs allow METRO to track changes in travel patterns regularly.

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NEW SERVICE CONCEPTS	TARGET MARKETS/ USER GROUPS
• Expanded Park-and-Rides	Commuters
• Oswego Loop Service	Intercity Commuters
• SUNY Oswego On-campus Service	University Students (20 percent total riders)
• Suburb-to-Suburb Service	Employees at Major Industry Site
• Jobs Express	Chrysler and Carrier Employees
• Fare Deal Program	Manpower Trainees

REASONS FOR HIGH PRODUCTIVITY

- Prudent service reductions (midday frequency cut from 30 min to 1½ hours)
- Elimination of least productive routes, primarily late night and weekend service
- Successful takeover of bankrupt bus carrier
- High percent student ridership
- 33 percent fare increase

SYSTEM PROFILE

CNY Centro operates transit services in three counties of northern New York State, Onondaga, Cayuga, and Oswego, as well as in the metropolitan area of Syracuse. Eighty-five percent of Centro's service is provided in Onondaga County, which includes the city of Syracuse. The remaining 15 percent is distributed evenly, 5 percent in Cayuga County, 5 percent in Oswego County, and 5 percent in intercity routes. Service in metropolitan Syracuse is delivered through a traditional radial system and one cross-town route. Current traffic patterns require additional cross-town service but financial constraints inhibit the ability to increase service.

As a result of cutbacks in funding (a 60 percent reduction in federal funding and a 50 percent loss in local funding), Centro experienced significant downsizing with a 20 percent reduction in service between October 1994 and April 1995 and an additional 20 percent cut anticipated in the next few months. These cuts in service led to a 6 percent decline in ridership and an increase in cost per mile. (In the State of New York, all local function is tied to mortgage recording fees; reductions in home sales led to the 50 percent decrease in the availability of local funds.) Public hearings resulted in cuts being made predominantly in late-night and weekend service.

A recently completed economic impact report showed that any major reduction in service would lead to increased costs to the taxpayer at the rate of $28 million because of increased unemployment and Medicare costs. With the proposed service cutbacks, it was estimated that 28 percent of the workers affected would probably become unemployed because of inability to get to jobs, 64 percent would be able to find another way to get to work, and 8 percent might or might not be able to get to work.

RIDER PROFILE (US Census Data 1990)

• 3.72 percent	Transit Riders
• 62 percent	Female
• 2 percent	Immigrants
• 24 percent	Black
• 69 percent	Single

According to management, Centro riders are typically female, 20 to 32 years old, working in downtown Syracuse. Centro experiences its highest ridership in January, February, and March during winter storms and the resulting hazardous driving conditions. The increases in ridership are highest among female riders. "DON'T SLIDE, RIDE" billboards are used to promote winter ridership.

SERVICES CHANGES THAT AFFECT PRODUCTIVITY

- Commuters

  Park-and-Ride Lots

  Centro expanded the number of park-and-ride lots from 2 locations in 1990 to 14 in 1995. Locations that serve as trip generators, such as major shopping centers, are used to provide the additional park-and-ride lots.

  Oswego Loop Service

  In 1993 and 1994, Centro took over the services of a bankrupt private bus company that provided connecting

service between the cities of Oswego, Fulton, and Mexico. With a change in service from local to express, travel time was reduced. Schedules were modified, routes restructured, and the level of service increased and integrated to provide better "connectivity." Since the takeover, ridership is up by 30 percent.

Cross-Town, Suburb-to-Suburb Route

Centro developed a new cross-town route that provides service to employees at a major employment site. One bus, carrying between 35 and 40 riders, travels between two suburban locations, allowing passengers to commute directly to work without having to travel into downtown first. When a major employer relocated its industrial site from one suburb to another, Centro added this new route to provide service to the new location. This new service is not subsidized by the employer.

Jobs Express

Centro operates a Jobs Express Route that shuttles employees from Cayuga County and Oswego County to the Chrysler and Carrier plants. The shuttles carry about 100 passengers each and travel on the New York State Thruway.

- University Students

  Centro recently took over all on-campus bus service for SUNY (State University of New York) at Oswego and is under contract to provide free transportation to SUNY students holding a valid student ID. University students account for 20 percent of total Centro ridership. The agency also provides on-campus service for Syracuse University and has done so for the last 20 years.
- Manpower Trainees and Employees

  Fair Deal Program

  During the summer, Centro introduced a monthly pass for a new and growing market. Centro is marketing monthly passes to Onondaga County to enable manpower trainees to get to JTPA programs and work sites.

  Monthly passes are also being marketed to employers. Ten to 12 employers participate in the Fair Deal Program. Employers are being encouraged to subsidize monthly bus passes and a guaranteed-ride-home plan that uses taxis, buses, or private vehicles. This program was just recently introduced, so it is too soon for an evaluation; passes were sold out in September, which is an indication that the program is working. The program is being promoted to employers with the suggestion that if parking is subsidized, monthly passes should also be subsidized.
- Special Events

  Centro provides special events service to Syracuse University football and baseball games. Shuttles run from park-and-ride lots to the stadiums. Special event service is provided to the New York State Fair held during August and September each year. Shuttles run from six remote park-and-ride lots to the fairgrounds. During the 12-day event, shuttles carry an estimated 450,000 fairgoers.

MONITORING PROCESS

On-board surveys are conducted two to three times a year. Demographic information is gathered to help identify potential markets. Telephone surveys of non-riders are also conducted regularly.

FARE STRUCTURE AND PASS PROGRAM

There is a complicated fare structure with eight zones and a $0.25 surcharge per zone. There is no surcharge for express service. On April 20, 1995, base fares increased by 33 percent from $0.75 to $1.00. Ninety-three percent of Centro riders pay cash fares.

Also in April of this year, the first monthly pass was introduced to compensate for the fare increase. An introductory price of $40 a month with unlimited rides was offered. On November 1, an extension fare pass became available at a $10 increment for each extra zone.

Centro provides 80 percent of bus service to junior and senior high schools. The Board of Education issues passes to students which are valid only on school routes and during school hours. The transit agency is reimbursed on the basis of the number of passes issued.

ROUTE-SPECIFIC INFORMATION AS AN INDICATOR OF GROWTH TRENDS

Because of a parking problem on the Syracuse University campus, a new route was introduced 3 years ago that provides service from a regional shopping mall with lots of parking spaces to the university campus. This route has the highest ridership in the system and is the fastest growing route in the system.

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NEW SERVICE CONCEPTS	TARGET MARKETS/ USER GROUPS
• New Transit Centers	Minorities, Transit Dependent, Transfers

- Bike and Ride Program — Cyclists, Environmentally Concerned Riders
- Environmentally Friendly Buses — Educated, Choice Riders

REASONS FOR HIGH PRODUCTIVITY

- Route expansion in minority areas
- Rapid population growth
- Special events and seasonal activities service
- Reduction in parking spaces at University of Arizona
- Express and limited express service

SYSTEM PROFILE

In 1969, the City of Tucson assumed control of the public transit system. With the exception of limited rural transit, public transportation in Pima County is restricted to metropolitan Tucson. Public transit services are provided primarily by Sun Tran's fixed-route bus system. Sun Tran operates within the City of Tucson and provides limited service to unincorporated Pima County, the City of South Tucson, and the Town of Oro Valley.

Sun Tran operates five types of fixed-route service: (1) radial routes (37 percent) provide service throughout the city and county; (2) connective routes (43 percent) provide service to facilitate transfers; (3) express and limited express routes (almost 20 percent) originate at park-and-ride lots and other major trip generators; (4) subscription service provides direct service to a specific trip generator; in this case, Hughes Aircraft; and (5) special temporary service is provided to special or seasonal events or activities, such as football shuttles. Accessible fixed-route service was initiated in June of 1991.

RIDER PROFILE (US Census Data 1990)

- 2.87 percent — Total Transit Use
- 50 percent — Female
- 16.5 percent — Immigrant
- 7 percent — Black
- 26 percent — Hispanic
- 63 percent — Single

SERVICES CHANGES THAT AFFECT PRODUCTIVITY

- Environmentally Conscious Riders and Cyclists
  1. Bike and Ride Program

     Sun Tran has equipped 142 buses in its fleet with bicycle racks that can accommodate two bicycles per bus and has installed weatherproof bicycle storage lockers at many locations, including park-and-ride lots and transit centers. The lockers are rented at a cost of $2.00 per month plus a key deposit. Sun Tran has also provided bike racks at some locations for people who would like to leave their bicycles at a bus stop and ride the bus. The cost for the project was $80,000. No performance tests have been conducted to determine if this project generated any new bus riders, but management considers the project to be a successful part of its attempt to attract "environmentally conscious" riders.
  2. Environmentally Friendly Buses

     Under the compressed natural gas (CNG) program, Sun Tran is gradually replacing the existing fleet with CNG buses. Currently, 26 percent of the fleet is CNG dedicated; projections are that 48 percent of the fleet will be converted by next year. Specific markets or areas are not being targeted; the older equipment is being replaced as needed. Consequently, the CNG buses are used throughout the system.

     These buses are more expensive to purchase and much more expensive to maintain. The CNG Program is primarily a marketing strategy to increase ridership, particularly among more educated riders. Sun Tran has no hard data to substantiate the claim that people like newer, cleaner buses, but management hears from riders that they do.
- Minorities, transfer riders

  Two new transit centers have been constructed since 1990. The Laos Transit Center, built in 1991, provides transfer service to riders from the neighborhoods on the southeast side of Tucson that are heavily populated by minorities. The new transit centers each provide a covered waiting area and other amenities. The Ronstadt Transit Center, built in 1993 in downtown Tucson, operates as a central transfer point with connections to all parts of the city and provides connecting service for Van Tran passengers.
- Special Events

  Sun Tran operates special events shuttles to University of Arizona home football and basketball games, the Rodeo Parade, the Gem and Mineral Show, the Rockies' spring training baseball games, and the Winterhaven Festival of Lights.

  University of Arizona football shuttle service began in the early 1980s, but since 1990, ridership has increased by 35 percent, despite an increase in fare to $1.00. Boarding points have been increased from the original two (at shopping malls) to four; stops now include Pima Community College and a large grocery store. Many of these shuttle users have become regular bus riders. Informal surveys conducted by management indicate that shuttle riders have become regular riders.

  SunTran has added six minibuses to its fleet for use on the downtown circulator route, the University of Arizona downtown shuttle, and for special and seasonal events or activi-

ties, such as the Winterhaven shuttle during the Christmas season and the University of Arizona football shuttles.

MONITORING PROCESS

Every 3 years, Sun Tran conducts a comprehensive marketing survey. In the interim years, the marketing team targets specific market segments with mini-surveys and telephone surveys. On-board surveys are conducted as needed on randomly selected routes. The surveys are designed to elicit information that will be used to increase ridership.

To add new routes, a comprehensive market analysis is done. The market is tested for 90 days, then surveyed for viability.

Sun Tran expects that new "environmentally friendly" buses will attract more riders with greater educational levels and more non-captive riders, particularly females 19 to 35, because of continuous construction delays on the interstate. Sun Tran also expects to see more riders with disabilities—some by choice and others because of changes in ADA eligibility requirements.

FARE STRUCTURE AND PASS PROGRAM

Fifty-five percent of Sun Tran riders pay cash; 45 percent use passes. Of the pass users, 15 percent are TUSD (Tucson Unified School District) students, 15 percent are employees, and 15 percent are social service clients. Student passes are sold to the school district at a discount and then distributed to the students; employee passes are sold to employers at full fare, then subsidized and sold at a reduced rate to the employee (21 employers, including the U of A, participate); social service passes are sold to agencies at one-third of the full fare then distributed by the agencies to clients for free.

Sun Tran also promotes a program, called GO CARD, which provides summer passes to students for $38. The University of Arizona Pass Program and Pima Community College Pass Program have shown increased use during the past few years.

There was a recent fare increase of $0.25 for regular riders, $0.10 for students, and $0.05 for senior citizens, riders with disabilities, and low-income riders. Sun Tran estimates that for every $0.05 increase in fare, ridership drops by 10,000 passengers per month, but overall revenue has increased. The normal increase in ridership is 8 percent, but it is actually up only 3 percent following the first full cycle after the fare increase. Transfers, which are free, are obtained when the fare is paid and are valid for 1 hr. Transfers are available for connecting buses and continued travel in either direction.

ROUTE-SPECIFIC INFORMATION AS AN INDICATOR OF GROWTH TRENDS

The routes in Sun Tran's service area that continue to grow the fastest are the #8 and #16. Both provide service from the minority neighborhoods to the downtown area and then to the outer edges of the city. Route #11, another of Sun Tran's most successful routes, provides service to such major destinations as the airport. Productive routes in the system, measured in ridership, are the downtown circulator, started only 5 years ago, and several express routes. These express routes that have a ridership of only 10 to 15 passengers will probably be phased out and the riders served by adding a leg to an existing route.

APPENDIX F

EFFECTIVE SERVICE CONCEPTS

RIDERSHIP EXPERIENCE OF SERVICE CONCEPTS

This appendix describes what is known about how service concepts actually affect transit ridership among the market groups. Only those service concepts effectively implemented by other transit operators and that have raised transit ridership are discussed.

For each service concept resulting in increased ridership, the research team sought to determine the following:

- Whether increased boardings represented new riders or the same riders traveling more often,
- Who the new or more frequent riders were (by age, sex, race, income, ethnicity, and so forth),
- Whether ridership gained by the service concept represented a real net gain—or whether it came at the cost of reduced ridership on other modes or routes,
- Whether ridership was gained by providing more service or simply different service (that is, whether ridership increased per input of service), and,
- If the service concept was really linked to the increase in ridership or if larger trends—population growth, increasing immigration, migration of the elderly—were simply causing ridership increases.

Unfortunately, many transit systems had little information on how the service option affected ridership because (a) the concept had only recently been implemented, (b) the concept was implemented as part of a package of options, (c) the concept was implemented to have a long-range effect (for example, marketing targeted to school children), or (d) the system did not have the resources to conduct detailed ridership surveys.

The research team included descriptions of a few service concepts for which no ridership data existed—such as transit-supportive neighborhoods or childcare facilities—because the concepts seem so promising or because they have been widely discussed. Most have operational experience but no data on ridership effect.

The first subsection describes those concepts which make transit feasible or practical for people; the second subsection evaluates those concepts which make transit more convenient. The third subsection describes those concepts which make transit faster or more direct for users, while the fourth subsection identifies those transit concepts which make service cheaper for the user. Each of the service concepts was described in the Task 1 report.

Concepts Which Make Transit Feasible/Practical

Reverse-Commute and Feeder Routes

Reverse-commute services can be provided directly or with suburban feeder services to traditional line-haul services. Over the last two decades, several transit systems have experienced a sizable reverse-commute ridership; the **Denver RTD** is a recent example. While constructing an HOV lane, the RTD operated buses in both directions along the freeway corridor and achieved a substantial reverse-commute flow. However, the lanes were designed to be unidirectional in the peak flow and, once the construction was complete, the RTD ended the reverse-commute service—to the complaints of riders. RTD staff report that it is not financially feasible to construct another lane for the reverse-commute service, given the capital expenditure already made.

The **Santa Monica Municipal Bus Line** (The Big Blue Bus Line) also discovered a low-income reverse-commute market when attempting to meet the needs of upper income CBD commuters. At the request of stock brokers who needed to be at work in downtown Los Angeles before 6:00 AM, the bus system began early express service. While the bus only carried 15 passengers per trip in the traditional direction, it quickly gained more than 55 riders in the reverse direction. The reverse commuters are domestic workers and day laborers working in Santa Monica who are new riders for the system. The Big Blue Bus Line had to add another bus leaving downtown Los Angeles at 6:10 AM to meet the reverse-commute demand.

Another example is the **Metropolitan Suburban Bus Authority (MSBA)** serving Nassau County outside New York City (and providing commuter service to Queens, Long Island, and Suffolk County), a subsidiary of the New York MTA operated by Nassau County. The system was originally established to provide feeder services to the subways going to Queens, but during the 1980s, staff noticed that these same routes were filling up in the reverse direction as light industrial and service jobs developed on Long Island. Reverse-commute ridership was not actively developed but has simply increased with new Nassau County employment opportunities; by 1988, the number of morning peak passengers traveling east (away from the subway connection to Queens) had exceeded the CBD-bound number. By 1993, reverse-commute passengers constituted 60 percent of all MSBA ridership.

The **Suburban Mobility Authority for Regional Transportation** (SMART) in suburban Detroit introduced a planned reverse-commute service—the "Job Express Shuttle"—in late 1994. The shuttle was designed to pick up passengers from central suburban transfer hubs served by the City of Detroit DOT and transport them to suburban job centers not previously served by transit; the service was targeted to poor inner-city commuters. Some of the shuttle stations are at the end of Detroit DOT's line-haul routes. Currently, three shuttles operate on a 15-min headway, from 5:00 AM to 7:00 PM, for a $0.50 fare; the shuttle will accept transfers and bus passes from the Detroit DOT's services. Ridership has been increasing steadily and the Job Express currently serves 400 to 500 riders per route per day (i.e., 1,200 to 1,500 daily overall). Studies show that 80 percent of riders are women, 98 percent are racial or ethnic minorities, and most are between 16 and 44 years of age. Ultimately, the shuttle is expected to serve 800 employers and 16,000 jobs within the service area.

Caltrans and the **Southern Pacific Company**, with financial support from San Francisco, San Mateo, and Santa Clara Counties, operate "CalTrain," a 47-mi-long heavy rail line between San Jose and San Francisco. They operate 52 weekday and 46 (total) weekend trains. Like many operators, CalTrain found that it had a growing number of reverse commuters. A 1989 detailed study of reverse-commute rider characteristics found significant differences between the traditional and reverse commuter: reverse commuters were younger, more likely to be male, not "quite so well off financially" and considerably less likely to have a car[1]. Reverse commuters starting in San Francisco were also more like to rate CalTrain as slower, more expensive, and less dependable than did traditional commuters[2].

NJ Transit, a statewide organization, has provided reverse-commute services in two major phases, the first in the 1980s when NJ Transit personnel worked with individual employers and business alliances; in the second more recent phase, personnel have focused more directly on inner-city residents.

In the first phase, NJ Transit began reverse-commute operations when Hartz Mountain Industries asked them to provide service to its new shopping mall and office complex, Harmon Meadow, located near the North Bergen park-and ride serving New York City. Reverse peak trips on the park-and-ride service were re-routed to serve Harmon Meadow, with Hartz paying the operating subsidy. The service continues today without subsidy because fares cover the operating cost[3]. After the success of this route, NJ Transit implemented 13 other reverse-commute or suburb-to-suburb services between 1981 and 1989. Roughly half of these 1980s services were considered successful and remain in operation.

For example, in 1987 NJ Transit was asked to re-route an existing route (No. 1 in Newark) to stop at the River Terminal Development Corporation; the transit system agreed to do so if the River Terminal would pay approximately $9,000 a year in additional operating costs. After just a few months in operation, the daily ridership (46) exceeded the break-even point (42), and the system continued the service without subsidy.

On the other hand, in the same year NJ Transit was asked by United Parcel Service in the Newark area to provide them with public transportation services; UPS had difficulty in recruiting semi-skilled workers for a noon to 4:00 PM shift and felt that the absence of direct bus service was the cause. UPS projected that between 45 and 75 people would use a direct bus service if the 29 route, which intersected virtually all lines in the greater Newark area, were extended to UPS. NJ Transit modified the service as requested, adding 4.9 hr to daily service, requiring an annual subsidy of almost $38,000 which UPS agreed to pay. Unfortunately, the service averaged only 3 riders per trip and UPS refused to continue to subsidize it after 3 months of operation, so NJ Transit discontinued service.

In analyzing all of their 1980s non-traditional commute services, NJ Transit noted that the commitment of the employer and the total travel time facing the employee were significant success factors. They concluded that costs could often be kept low enough to maintain service if unused capacity was activated and route deviations requiring little additional operation time were used. Specific examples included the high level of service they were able to provide to New Jersey work locations drawing New York employees because they had so much excess capacity in the reverse direction (given the extensive NJ Transit service to New York). They were also able to cheaply provide service to employers located close to an existing route and having shift times that matched existing bus schedules. NJ Transit calculated that any employer more than 5 mi from an existing bus service (or those with unusual shift times) required an extra driver for the new service.

NJ Transit maintains an active Business Transit Alliance program to work with employers in developing and planning new services, particularly those which employers are willing to help subsidize. In addition, in 1993, NJ Transit began a series of experimental reverse-commute routes from the inner-city to suburban employment concentrations with a CMAQ grant; these services were part of their overall Project CONNECTION. The experiment included three types of service: additional inner-city-to-suburb routes, suburban feeder routes, and suburb-to-suburb services.

The NJ Transit expansion of inner-city service has been the most successful new service concept, particularly the extension of service hours. The least successful of the services have been the routes entirely in the suburbs, particularly those operating in HOV lanes, because they did not provide frequent enough headways to be attractive. Moreover, it was difficult to adequately serve spread-out suburban locations with the resources available. The feeders to rail were only moderately successful because employees were required to make at least one and sometimes as many as three transfers.

The routes from inner-city Newark to the suburbs, begun in January of 1995, have had the best ridership response—approximately 25 passengers per vehicle trip. Staff believe that the frequent headways and direct service, coupled with connection to suburban routes, are responsible for the success in attracting inner-city riders. During the day, the service schedule is varied to address rider characteristics; the most popular trip is at 9:40 AM, geared to serve employees of two major companies with shifts beginning at 11:00 AM. The Newark services also help job seekers to travel to interviews, providing an incentive to seek suburban jobs.

NJ Transit staff believe that cooperation with suburban businesses has contributed to the success of the reverse-commute services. For example, high demand on the Newark routes has led to the addition of Sunday services to both suburban employment centers and shopping malls. This has doubled the total number of vehicle trips, including adding extra capacity on very early morning trips—even the Sunday 8:00 AM bus was operating at capacity, so a route was added at 7:00 AM. Although NJ Transit has not done studies of rider characteristics, most of the riders are assumed to be inner-city minority commuters.

Because the experimental funding will shortly run out, NJ Transit has established criteria for continuing individual services. To remain in operation, the extension of an existing route must have a 15 percent recovery ratio in the first year and a 20 percent ratio in the second. If the reverse-commute route was a new one, it must recover 20 percent of its costs in the first year, and 25 percent in the second. Some routes have failed to meet these criteria; the suburb-to-suburb ones are the most obvious, although some inner-city-to-very-low-density suburban routes have not done well either.

A well-known system of suburban reverse-commute feeder services is the "200-Series" routes operated by the **Southeastern Pennsylvania Transportation Authority (SEPTA)** (Philadelphia). SEPTA may have developed the first major express reverse-commute route more than 30 years ago—a route still in operation. The current Route 124/125 was started when a major employer expanded, locating employees to the King of Prussia/Valley Forge area. The new bus route essentially connected the two work locations of this major company. King of Prussia at that time was an outlying area but offered convenient access to major highways. The area has since developed as the major subregional center with extensive retail and employment.

Approximately 10 years ago, in response to suburban growth, SEPTA redesigned and improved this service, making it the trunk portion of a suburban network oriented to a King of Prussia transportation center. In comparison with many other express and reverse-commute routes, Route 124/125 is unparalleled. Service operates on a 10-min peak headway on the trunk portion to King of Prussia. There is a long span of service on both weekdays and weekends. Traditional transit coaches are used, though at one point articulated coaches were assigned. The major outbound boarding locations are Center City, Philadelphia, and a transit center approximately 5 mi from downtown. In addition to providing direct service to attractions along the route, this bus route serves as a major connection between the city and suburban areas.

SEPTA's 200 series began in the mid-1980s. In September of 1986, the developer of a group of suburban business campuses approached SEPTA and asked for a new bus service to link the employers there to the nearest suburban rail station. SEPTA's original analysis showed that the route would only carry 60 percent of the ridership needed to recover the cost of operations strictly through fares. The developer and the major tenants agreed to subsidize the difference. Route 201 was heavily marketed by SEPTA and began service in March of 1988. By June, Route 201 had 186 riders—more than enough to cover operating costs. By September, the route was carrying 237 passengers and SEPTA was using the profits to subsidize the rail system[4].

Because of the success of Route 201, SEPTA began planning more than a dozen 200-series routes between suburban rail stations and employment areas. In general, 200-series routes are only established when employers call and request them. SEPTA staff then develop a cost proposal for the requested service and require that interested parties pay for that service quarterly; the cost structure guarantees that SEPTA will break even on incremental expenses. The average cost to each employer is about $15,000, which reflects a "credit" for the train fare paid by employees using the bus on the grounds that they would not have used the train unless the 200-series bus existed.

Most of the 200-series routes run in peak periods only, although some offer hourly service during the off-peak. Most routes carry two-thirds of their riders in the morning peak so that a significant number of riders travel only one way with the feeder bus. One route, serving AARP and the Prudential Insurance Complex, operates during non-peak hours for shift workers and for job interviewees. Routes carry from 10 to 20 passengers per daily trip.

Because the 200-series routes were a bus-to-rail service, SEPTA coordinated bus with rail schedules to make intermodal transfer as smooth as possible. For example, buses are scheduled to meet reverse-commute trains on 30-min headways; in addition, some stations have been modified so that buses come as close to the trains as possible.

Ridership peaked at 800 riders per day in 1991 and has been falling since because of lay-offs and economic downturns affecting employment. In the beginning of 1995, SEPTA had five operating 200-series routes, all serving suburban rail stations, and most significantly subsidized by private employers. One of the original routes had been canceled because of declining ridership and another had been changed to Saturday-only service. Two routes were breaking even on marginal costs and a third covered 90 percent of its operating costs.

When Sears moved from the Sears Tower in the Chicago CBD to a suburban location 35 mi away, **PACE**, the suburban

bus division of the Chicago RTA, worked with the large employer to try and retain transit ridership among the relocated workers by re-routing two routes, organizing vanpools, and providing subscription services. Roughly one third of the riders on these three services are reverse commuters, coming from Chicago to the suburban Sears work site[5].

In Tucson, with a grant from DOT designed to promote alternatives to the private car, the city transit system, **Sun Tran**, began one reverse-commute route and one suburban extension of an existing route to serve a large aerospace firm, a major mall, and several resort hotels. Service was provided 7 days per week, on 30-min headways during morning peak periods and 15-min headways during the PM peak. Although designed to accommodate workers, the route did not provide express bus service; it took roughly 68 min to make an 11-mi-long trip.

While the extended route has exceeded its goals, its ridership has turned out to be suburban residents riding to suburban destinations—not reverse commuters. Route 16, the genuine reverse-commute route, did not do well at all; although ridership projections were in excess of 200 people daily, the route actually had only 33. Staff attribute its failure to downturns in the economy, the need for shorter headways, and public perception that transit is not reliable; they also questioned whether transit and work schedules coincided and whether the trip was simply too long.

The **Central New York RTA** (Centro) in Syracuse operates a Jobs Express that shuttles employees from Cayuga and Oswego Counties to Chrysler and Carrier plants. The routes each carry 100 passenger per day, traveling on the New York State Thruway.

Cobb Community Transit (CCT) provides feeder services to and from MARTA stations in Atlanta and DeKalb county; originally designed to take suburban residents to five suburban MARTA stations (because MARTA does not reach Cobb County), the system found itself with growing reverse-commute ridership as people learned how to use the system. CCT has an agreement with MARTA which allows it to only service rapid rail stations and which permits free transfers between the two carriers. However, an examination of their route structure makes it clear that CCT actually provides significant service in downtown Atlanta which facilitates reverse-commute activities.

CCT Route 10, which has the highest volume of reverse-commute ridership (almost 3,400 trips weekly) stops at four major MARTA stations in the city (Five Points, the Peachtree Center, the Civic Center, and the Art Center) before traveling to suburban Cobb County in closed-door operation. In Cobb County, Route 10 makes four stops, including stops at a large hotel and at a major regional shopping mall. Another CCT route stops at the Lennox Buckhead station, which is a large new employment and residential area serving as the hub of the rail network. All buses, including Route 10, operate during the peak only. Staff indicated that some reverse-commute riders had asked for the provision of direct downtown Atlanta to Cobb County service but that the closed-door agreement with MARTA precluded such activity.

The **Broward County Mass Transit Division** has a reverse-commute route, #18, which has one of the highest number of passengers per hour of service in the system; it provides access from the largest inner-city minority neighborhood to a suburban shopping center and to a community college campus.

The fastest growing route in the **Sacramento Regional Transit District** (RT) system is one that travels from downtown on the interstate to South Natomas—the highest density area outside the CBD—and then to the Arden/Del Paso Light Rail system. This route carries 1,200 passengers a day, with almost 42 passengers per vehicle hour of service (34 percent higher than the system average). It also has a higher than average fare recovery ratio.

The **Capital Metropolitan Transportation Authority** (Austin, Texas) had several reverse-commute routes, which were not successful. Currently, they operate a suburban feeder service to and from an express bus stop in a high growth suburban area with many industrial sites. They have numerous reverse commuters on that particular route—some inner-city workers and some students traveling to a community college in the area.

The **Long Island Railway** had a reverse-commute service on its Port Jefferson line which was not successful, possibly because of the limited level of service.

APTA undertook a survey of its membership in 1992 and found that 61 percent of the 56 respondents provided some form of reverse-commute service, generally in direct response to employer/employee needs. Most respondents—86 percent—said that their programs were targeted to specific suburban employers. Sixty-three percent of the respondents reported focusing on inner-city residents; a smaller number served job training or special employment programs. Many of the respondents also reported offering more than bus or bus-to-rail connections; for example, 25 percent of respondents provided vanpools from inner cities to suburban employment concentrations.

Although the term "reverse commute" often conveys the image of poor inner-city workers traveling to suburban jobs, professionals and managers are often riders as well. For example, a TMA representing a group of employers has been responsible for several feeder projects in the Princeton, New Jersey, area which serve largely high-income workers coming from New York and Philadelphia.

The **Greater Princeton TMA (GPTMA)** was formed in 1984 as a non-profit corporation whose goal was to initiate traffic reduction programs in the growing Princeton employment concentrations. Within a few years, several major firms relocated from Manhattan and wanted to keep their Manhattan employees; in 1987, Merrrill Lynch initiated and paid for a shuttle to transport employees 5 to 7 mi from the rail station on the New York and Philadelphia line. When First Boston and American Reinsurance relocated

from Manhattan, they too tried to start their own shuttle services; the developer of the employment complex, the Forrestal Center, in which they were located suggested developing one shuttle service for all three firms.

GPTMA was asked to administer and broker the service; it received an UMTA/FTA Entrepreneurial Service Grant for planning expenses. Once the service was planned, GPTMA requested proposals for service and awarded the contract to a local limousine company. (Staff report that, because of proximity to Atlantic City, many private carriers in the area have excess capacity.) The local public transit operator, NJ Transit did not bid on the service because smaller, non-diesel vehicles were specified and because union requirements kept its operating costs higher.

The current service has been operating successfully since October of 1990, with an average daily ridership of 75. The shuttle meets trains during morning and evening peak periods (7–9:30 AM, 4–6:30 PM); the employee pays nothing while each business pays $104,000/year in operational expenses plus 10 percent administrative fees (GPTMA member firms pay 8 percent). GPTMA is responsible for scheduling and coordinating buses with train service and for providing ridership and marketing information.

GPTMA staff attribute the success of the shuttle to several factors: the long history of shuttle service by Merrill Lynch before the coordinated service was begun, the willingness of employers to pay all associated costs in order to retain high-level white collar and executive employees, and the developer's use of the service as a marketing tool in attracting other employers to the area.

Another shuttle service in a suburban center close to the Princeton Forrestal Center has also been successful. The Route 1 "Carnegie" corridor in Mercer County is an employment concentration located near but not at a commuter rail station along a high-speed line serving New York, Newark, and Philadelphia. The area has both residential and campus-style office parks, which are part of the rapid office growth in Princeton; it is 1.4 mi from the Princeton Junction commuter rail station.

The area's developer began a shuttle service in 1988, the **Carnegie Haul**, to enhance the attractiveness of the Carnegie Center in West Windsor Township; the developer originally paid all of the costs and the service was free to employers. The shuttle runs from 6 to 10 AM and from 3 to 8 PM on a 25-min headway, meeting all outbound trains. Employees ride free, but local residents pay. A clustered campus-style office park, the center consists of 20 buildings with an average of six bus stops per run with no more than ⅕ mi between stops. The Carnegie Center also includes 550 medium-density residential units which generate traditional suburb-to-center city commuter rail ridership to New York and Philadelphia; residential ridership accounts for nearly 60 percent of the total daily ridership on the Carnegie Haul. The residential ridership has a 6:30 to 7:30 peak and the reverse-commute feeder has a 7:45 to 8:45 peak—the same bus can service both residential and office locations.

A 1991 study by Marchwinski and Fittante[6] found that about 20 percent of the Carnegie Haul riders came from New York City. Of the remaining riders another 20 percent came from Newark, a little more than 7 percent came from Philadelphia, and an equal number came from Princeton. In total, roughly 75 percent of riders were reverse commuters traveling an average of 28.5 mi. When asked how they would make the trip if the shuttle were discontinued, almost 40 percent said they would come to work in a car (as a driver or passenger), and 19 percent said they would take a train or taxi. No one said that they would not make the trip without the shuttle service.

Another shuttle service was organized in the Middletown/Homdel area of Monmouth County, New Jersey, to serve several separate AT & T facilities in a rural suburban area, the furthest of which is 7.5 mi from the North Jersey Coast Line, a 66.7-mi-long rail route with direct service to New York City. The AT & T shuttle connects to the Middletown rail station, approximately 40 mi from New York City. However, Marchwinski and Fittante found that more than 80 percent of the AT & T shuttle riders came from further south of the work site and not from New York; the average trip was 14.4 mi. When asked what mode they would use if the shuttle were discontinued, 10 percent said that they would no longer make the trip while more than 40 percent said that they would drive.

Feeder Routes

The **Potomac and Rappahannock Transportation Commission** (PRTC) in Prince William County, Virginia, near Washington, DC, operates OmniLink shuttles on five routes serving three stops on the Virginia Railway Express (VRE), largely taking commuters to the DC area (25 to 30 mi away). OmniLink's services are coordinated with train schedules, although riders may flag the bus down anywhere along the route. Having a VRE ticket allows a person to ride OmniLink for free. The service began in December of 1994 with an average of 100 trips per day; by August of 1994, there were almost 350 daily trips.

Many riders commuting to Alexandria, Virginia; Crystal City in Arlington, Virginia; or Washington, DC, have been encouraged to use VRE by the availability of the feeder service. Twenty-nine percent of OmniLink riders are going to work; almost 26 percent are going shopping, 15 percent are going to the doctor, and 11 percent are making social or recreational trips. Staff report that approximately 32 percent of OmniLink riders to the three VRE stations are new VRE riders. OmniLink riders are very different from overall VRE riders. The typical VRE rider is male (60 percent) and has a very high income: almost half have household incomes above $75,000 while 22 percent have incomes above $100,000. A December 1995 study found that the typical OmniLink rider, however, is female (61 percent), under 45 (79 percent), and fairly poor—64 percent have incomes below $25,000. Many of those using the shuttle formerly

made the trip by car—21 percent drove alone, 29 percent were car passengers, and 22.3 percent had used a taxi for the trip.

In 1991, the **Metro North Railroad** (suburban New York City) began providing a rail feeder service, the Hudson Rail Link, to suburban commuter rail stations offering service to New York City. Five shuttles currently operate on fixed routes during peak hours throughout the communities near the rail stations, feeding the stations; two routes are offered in the off-peak. Service is provided from 5:45 AM to 11:45 PM, every 15 min during the peak, every hour off-peak; fares range from $0.25 off-peak to $1.25 in the peak.

Average daily ridership is about 1,000 trips per day—an 11 percent increase between 1993 and 1994, and a 5 percent increase between 1994 and 1995; ridership is highest in winter months when it is more difficult to reach the station by other means. Ridership at the two stations served by the Rail Link increased by a third from 1991 to 1993, or 300 new rail passengers. Rail Link riders are very different from the typical Bronx transit user; roughly 71 percent of the riders have incomes over $50,000 (47 percent have incomes above $75,000). About two-thirds of Link riders are women and 41 percent are over 45 years old (18 percent are over 55).

The **Norwalk Transit District**, in conjunction with the Connecticut DOT, recently began feeder service between the Greenwich rail station and downtown Greenwich, from 7:42 AM to 9:00 AM and from 3:56 PM to 6:19 PM each weekday. The service carries between 88 and 106 trips per day. The Transit District also began two feeder routes from the South Norwalk train station and the Merritt 7/South Wilton employment corridor (with more than 13,000 employees). Although the services were free for the first 6 months, ridership in May of 1995 was only 63 passenger trips per day. The lower ridership is attributed to the long travel time and the indirect routing to northern employment concentrations[7].

In 1991, Shore Line East Commuter rail service was established between New Haven and Old Saybrook, Connecticut; **Connecticut Transit** initiated the Commuter Connection Shuttle service to connect the New Haven downtown with Union Station served by the new commuter rail service. The feeder service operates when the Shore Line East trains run, from roughly 6:30 AM to 10:00 AM and between 3:00 PM and 9:00 PM. Riders can pay by adding a small surcharge to their monthly rail commuter ticket. Daily ridership is about 440 riders[8]. This is one of the most effective feeder services operated by Connecticut Transit, probably because the schedules are so well coordinated with those of the rail system and there is an integrated fare system.

The **Connecticut DOT (ConnDOT)** began feeder services from Stamford's Metro North Rail station, served by more than 140 trains each work day, to downtown Stamford. The service operates from 6:15 AM to 9:37 AM and from 2:48 AM to 7:27 PM carrying about 140 passengers per day. ConnDOT is considering adding shuttle services to the South End employment corridor and modifying existing local bus routes to serve these locations[9]. No ridership data are available on either of the ConnDOT feeders described here.

The **Lehigh and Northampton Transportation Authority** (PA) instituted a shuttle service allowing passengers to transfer to the core service at transit centers throughout the system; system ridership increased by 8 percent[10]. The **Dallas Area Rapid Transit** District (DART) operates a network of fixed-route feeders to regional buses and rail; ridership has increased steadily on these services at 7 to 8 percent a year[11].

Many transit systems provide feeder services for special and sporting events. The Boston **Massachusetts Bay Transportation Authority** (MBTA) runs very successful feeder services from rapid rail stations to the Patriots games; while it took time to develop the market, they now experience high ridership. The MBTA has also had a high ridership response to large special events; when SAIL BOSTON brought tall ships to the harbor, the system ran a massive shuttle service from the revamped South Station to the waterfront, carrying 2 million riders per day.

Service to Large Employers, Schools, and Universities

PACE, the suburban bus division of the Chicago RTA, operates nine subscription services for Sears' employees under contract to private operators. Sears relocated from the Sears Tower in downtown Chicago to the Hoffman Estates, a suburban development 35 mi from the Chicago CBD. PACE worked closely with Sears to attract approximately 25 percent of the workers who had previously used transit; the subscription services were one of three alternatives offered employees (the other two were vanpools and new fixed routes). The subscription services provide nearly 200,000 annual rides; they are open to the general public, although geared to Sears' needs, and fares are set to equal 60 percent of the cost of service. PACE will not begin a subscription service until there are 30 passengers. Most of the subscription bus riders drive their cars to the origin of their routes and pay $88 per month bus fare; the average commute is 47 mi one way.

Community Transit (serving Snohomish County, north of Seattle) operates 11 customized routes serving Boeing, the largest employer in the county; while open to the general public, the routes are scheduled to meet Boeing shifts and needs. These routes carried 264,000 riders in 1994 or about 5 percent of all system riders. However daily ridership has been dropping drastically—almost 29 percent between 1993 and 1995—because of dramatic personnel changes and layoffs at Boeing in the last 3 years.

Several privately run shuttles operate to and from the **New Haven Union Station** connecting with the Shore Line East Commuter rail service initiated in 1991. Two hospital complexes (Yale/New Haven and St. Raphael's) each operate

feeder services for their staff, carrying 57,000 and 20,800 annual riders, respectively. In addition, Yale University operates two shuttles with an annual ridership of almost 41,000, while the Maritime Center at Long Wharf also operates a shuttle to Union Station[12]. Plans are underway for additional private shuttle services.

The **Santa Monica Municipal Bus Line** (The Big Blue Bus Line) introduced commuter services between Santa Monica and El Segundo, an area where large arospace firms, including TRW and Hughes, are located. With funding from the air quality district, the transit system carefully constructed routes and purchased four 30-ft-long buses with reclining seats and TVs. Although the buses can carry 25 passengers on the 45-min 20-mi trip, they are carrying 10 riders per trip.

Many transit systems have found local universities to be fertile ground for increasing ridership. **Community Transit** (north of Seattle) is one of two transit systems serving the University of Washington through its U-PASS program which began in 1991 (described in a subsequent section). Campus-based ridership is now an important part of CT's service; it carries the largest number of riders per vehicle hour (31.8 compared to a system average of 21.8). In 1995, CT had almost 2,500 boardings per day on its university based routes, or a 7 percent increase since 1993. Overall, this is slightly more than 12 percent of the system's daily boardings.

In 1990, the **Champaign-Urbana Mass Transit District** (MTD) decided to focus a series of services at University of Illinois students. The system began with a shuttle from a remote parking facility to the main campus; other routes were quickly added to provide frequent service for short trips around campus. Today the MTD operates the Quad route from 7:30 AM to 5:30 PM, Monday to Friday with a 5-min headway, the Scamp route to new buildings on the edge of campus on a 20-min headway over the same period, and a parking shuttle on 5-min headways over a slightly longer day. Finally, the MTD operates the Illini campus circulator which operates from 7:00 AM to 2:00 AM on 15-min headways during the day with shorter headways—largely for security reasons—at night.

Before 1990, the MTD had less than 3 million annual passengers; after it began service to the university, annual ridership grew to 8.5 million passengers in 1995. The average number of riders carried per hour of service rose from 41 (right after the change) to 53 six years later. In 1995, the campus services accounted for 35 percent of all MTD riders; weekday services to the community accounted for 45 percent, while the remaining ridership was on the weekend and evening services. Weather has a differential effect on ridership; in bad weather, ridership on the community services goes down because most trips are discretionary; however, university ridership goes up in bad weather because the trips are not discretionary and people unable to drive, walk, or bike also use the bus.

Students pay a mandatory $18 fee each semester—this permits them to access transit service simply by showing an ID. The university subsidizes 80 percent of the cost of a semester transportation pass for both faculty and staff; this allowed the university to eliminate more than 1,000 parking spaces and postpone $5 million of parking garage construction. The MTD ridership push was helped by the university first raising parking fees by 30 percent in 1989 and by an additional 24 percent in 1990.

In 1989, the **Capital Metropolitan Transportation Authority** in Austin, Texas, took over a fare-free system formerly run by the University of Texas, Austin, for its students; at that time, the university was carrying more passengers per day than the city system—roughly 40,000 boardings daily when the university was in session. The university's system, which began as a local circulator serving fraternity houses near campus, had grown exponentially and served apartment concentrations and student housing complexes more than 10 mi from campus—it paralleled the city system at several points. Although students were supposed to show a student ID to use the system, drivers generally did not ask for proof of student status; as a result, Capital Metro felt that it was losing substantial ridership to the university's system. Today, the city runs the original routes and also develops shuttles, vanpools, and circulators to serve campus needs.

The **Sacramento Regional Transit District** (RT) provides several services connecting the light rail system and California State University; special routes also operate through campus and connect nearby apartment complexes to the campus. The university's student association developed a special student pass which allows students to ride without paying a fare when showing a picture ID. Since the initiation of this pass, whose costs are subsidized by the student association, ridership on campus routes has increased 300 percent—to account for roughly 7 percent of total RT ridership.

The **Santa Monica Municipal Bus Line** (The Big Blue Bus Line) carries a substantial percent of its total ridership—13 percent—to the University of California, Los Angeles. After the 1994 earthquake, the Santa Monica Community College paid the bus line to provide shuttle service from a remote parking lot to the college; the shuttle carries 800 passengers per day.

The **Central New York RTA** (Centro) in Syracuse recently took over on-campus services for the State University of New York at Oswego; under contract to the university it provides fare-free services to all students holding a valid ID. In addition, Centro has provided on-campus service to Syracuse University for more than 20 years. Together, the two university services account for more than 20 percent of total system ridership; moreover, the route with the fastest growth is a new one linking a regional shopping mall, which has substantial parking, with Syracuse University. The route, begun in 1992 to address the university's growing parking shortage, is the fastest growing and has the highest ridership in the system.

The **Port Authority of Allegheny County** (Pittsburgh) recently arranged direct service from two neighborhoods to the University of Pittsburgh campus; the university pays PAT a flat fee of $4,000 per week. The university is the largest employer in the area as well as a large student trip attractor. Students and others access the system by showing a picture ID. The service has been successful and PAT hopes to expand it to other universities.

VIA Metropolitan Transit (VIA) in San Antonio, Texas, recently implemented a series of circulator routes connecting large apartment complexes—previously unserved by transit—with both the University of Texas campus and the UT Medical School complex; the routes also serve some firms which hire students for part-time work. The routes are all fairly short; the average trip length is less than 3 mi. Buses run every 30 min in the peak and once per hour off-peak.

PalmTran in West Palm Beach, Florida, is restructuring its entire route network to attract the kindergarten through 12th grade student market. Routes will be redirected so that 46 out of 49 grade, middle, high, and vocational schools will be on one or more bus lines; there will be 32 new routes and more than 2,200 new stops. Surveillance cameras with sound will be mounted on all 143 buses in the system to reassure both students and their parents. To create an incentive for older students to ride transit, PalmTran will offer a $10 monthly pass (the current student fare is $0.50 a ride or $18.50 for a pass). The new network is expected to be in place for the 1996-97 school year.

In 1989, **Transfort**, the transit system operated by the City of Fort Collins, Colorado, decided to focus new services on students at Colorado State University; before that time no special efforts had been made for this large trip attractor. As the result of a marketing study, Transfort restructured city service, added two new routes to the campus, and rescheduled buses to better meet campus schedules; within 1 year, system ridership was up dramatically while CSU ridership alone increased 300 percent. Currently, the university has no special pass system, although Transfort is trying to get the university to institute a mandatory pre-paid pass (that is, the cost of the pass would be part of the mandatory student fee)[13].

Guaranteed-Ride-Home Programs

Houston Metro recently implemented a GRH to provide a "security blanket" for suburban park-and-ride users without mid-day service access. The program allows a rider up to three emergency rides each year. Metro contracts with private taxi companies to provide rides to either the park-and-ride lot or the site of the emergency. In January of 1996, 76 rides were provided at an average cost of $28.87 (including a 6 percent discount provided by the taxi operators).

The **Boulder Department of Transportation** provides a guaranteed-ride-home program to riders holding its EcoPass (described in a subsequent section); passholders are entitled to unlimited GRH service anywhere within a 100-mi one-way distance. The DOT contracts with taxis for service in case of emergency or if the rider missed the last bus of the day.

Virginia Railway Express (VRE) has a guaranteed-ride-home program called "Special Delivery." In case of illness or emergency in the family, the rider calls VRE's Special Delivery operator, who arranges for a taxi or sedan service to pick up the rider at the office and take them to where they need to go. VRE reimburses the rider for 90 percent of the pre-approved fare, up to $100 per trip. The program allows for three rides per year at 90 percent; if an individual must use the service more often, additional rides are reimbursed at 50 percent.

Studies have found that guaranteed-ride-home programs do affect employee transportation decisions. A 1992 study at the Warner Center in the West San Fernando Valley (Los Angeles) found that more than 59 percent of employees surveyed said that a GRH was important when deciding whether to use an alternative to driving alone[14]. Elizabeth Burn's evaluation of 525 worksites in Phoenix shows that a guaranteed-ride-home program is positively linked to a small reduction in single-occupant vehicle use[15]. Guiliano, Hwang, and Wachs also found a positive relationship between guaranteed-ride-home programs and reduced single-occupant vehicle use in the Southern California area[16]. However, changes in driving alone do not always, or even usually, translate into increased transit ridership.

Travel/Mobility Training

Travel training programs for people with disabilities have been a major part of many social service agency agendas; until recently transit operators themselves have had minimal involvement (sometimes, but not always, offering free or reduced cost passes for trainers and students). The requirements of the Americans with Disabilities Act (ADA) are a serious incentive for transit operators to either conduct travel training programs themselves (often contracting with social service agencies to do training) or to work more cooperatively with the agencies actually doing such training.

In 1991, the Community Forum in Phoenix, in cooperation with the **Regional Public Transit Authority** (RPTA), conducted travel training for 89 people in wheelchairs, using trainers who were themselves in wheelchairs. Without any change in service, schedules, or fares, ridership of fixed-route accessible buses by people in wheelchairs went up more than 75 percent on the route in question after the training was over.

In 1994 and 1995, **Capital Metro** in Austin, Texas, worked with the Center for Independent Living to travel train 180 people with various disabilities. The center undertook the training; Capital Metro tracked the effect on paratransit and transit ridership. A year after training, 170 of the 180 trained users were still using fixed-route services for at least some of their trips. Almost 29 percent became frequent users, riding regular buses 7 or more times per week. An additional

34 percent rode fixed-route transit 1 to 3 times per week. The Center also surveyed 100 of the 200 people who had been trained between 1990 and 1993, 85 percent still made at least one trip per week on fixed-route transit. The effect on paratransit ridership was clear.

In the last 5 years, Project ACTION of Easter Seals, funded by the US DOT, has supported more than a dozen local demonstration projects of various travel training programs for people with various disabilities. In many cases, the major goal of participating transit systems was to induce (or even require) people with disabilities to use fixed-route transit instead of substantially more expensive ADA-complementary paratransit.

Ironically, like the Austin system, few were able to show much diversion from paratransit; however, all of these programs increased fixed-route ridership by people with disabilities, often substantially[17]. Reno, Baltimore, and Columbus, as well as the systems discussed in this section, gained riders. These findings suggest that a market exists among people who have disabilities but either do not qualify for, or do not totally depend on, paratransit; when appropriately travel trained, they will become regular fixed-route transit users.

This may be confirmed by a recent TCRP project which surveyed 724 people with disabilities in six communities, finding that an average of 69 percent had used regular fixed-route transit, including roughly 58 percent of those in wheelchairs and 66 percent of those with sensory disabilities. The frequency of use was not high, but roughly 13 percent of the surveyed people with disabilities had used fixed-route service more than 100 times in the previous year and roughly 20 percent had done so between 10 and 100 times[18].

The **Miami Valley Regional Transit Authority** in Dayton, Ohio, has a full-time in-house staff person who trains both individuals and small groups—about 180 people per year. As a result, there has been a significant increase in wheelchair boardings on fixed route; there are roughly 2,000 boardings each month or a 40 percent increase over pre-training ridership. The **Sacramento Regional Transit District** has long had an active travel training and travel facilitation program for people with disabilities. SRTD trains about 400 people per year and studies show that about 80 percent continue to use fixed-route service after 1 year[19].

The **Greater Bridgeport Transit District**'s travel training program found that more than 80 percent of all those trained were still using fixed-route service 1 year after training, each person making an average of six one-way trips per week. In the first years of the program, training was focused on people with disabilities; in the third year, a group of 50 seniors attending a daily meal program requested training[20].

Marketing and Advertising

The **Broward County Mass Transit Division** (BCt, Pompano Beach, Florida) has maintained a 4 percent steady increase in annual transit ridership, despite fare increases, because of the heavy promotion of the system. Since 1988, they have had a substantial increase in the number of people with disabilities using the system, largely because fixed-route service is better and more reliable than the paratransit services. Today, roughly 28 percent of the agency's riders are either people with disabilities or the elderly. The BCt has made special marketing efforts for these kind of travelers; for example, they revised the transit guide, color coding routes for use by those with developmental disabilities, non-readers, and those who cannot see small print.

The **Santa Monica Municipal Bus Line** (the Big Blue Bus Line) has experienced ridership increases among Hispanics; it attributes this to its marketing efforts with the Catholic Church. **Foothill Transit** (Los Angeles) estimates that between 20 and 30 percent of its ridership is Spanish-speaking; as a result they have developed their communications campaigns to appeal to current and prospective Hispanic riders. Their marketing efforts include bilingual versions of most printed materials and publicity efforts in media serving the Hispanic community. Although they have no direct way to know the effect of these programs, Foothill Transit believes that these efforts account for some of the growth in Hispanic system ridership.

Calgary Transit conducted a 1994 telephone survey with current transit riders; they found that rider security concerns might be affecting ridership, especially among those riding at night. In response, the system improved lighting at several bus stops and rescheduled cleaning crews at C-Train stations, to give customers an additional feeling of safety[21].

Concepts Which Make Transit More Convenient

Route Deviation

There are several different kinds of route deviation services—the bus can (a) deviate anywhere along the route, (b) deviate only to pre-arranged stops (e.g., senior centers and hospitals), (c) deviate along some parts of the route but not in others, or (d) have fixed stops but deviate anywhere in between stops. Many systems make little distinction between flex-routes—covered in the section below—and these services.

A small system which allows deviations anywhere along the route is the **Grays Harbor Transportation Authority** of Hoquiam, Washington. The system offers several kinds of route deviation; first, there is one major route which serves all the small towns of the county allowing deviation on request. In addition, three "satellite" routes serve areas away from the major route. These satellite routes meet the major route at scheduled stops as well as providing service to a passenger ferry. The system has been in effect for almost 20 years.

Jefferson Transit in Port Townsend, Washington, provides route deviation anywhere along a 40-mi one-way route

connecting small areas in the Puget Sound. Riders must call and request service 15 min before desired pick-up, or, they request a deviation upon boarding. In essence, all of the 21,000 trips taken per year are deviations.

Another small community, also in the Northwest, is Newport, Oregon; **Central Coast Connections** offers three routes in Lincoln County, a 992-sq mi area with 40,000 people. The buses will deviate up to ¾ mi from the regular route when passengers call in advance, request the service when boarding, or flag the bus down along the route. Although the system has few deviations—roughly five per week—there have been some complaints from the general ridership about the delays associated with route deviation. The system has noted a very small decrease in paratransit ridership by people in wheelchairs, although elderly riders have continued to depend on paratransit.

Several slightly larger communities also have tried route deviation. **Rural Transit**, operating in two rural counties near Bloomington, Indiana (population 128,000), operates a route every other day from which the bus is permitted to deviate only ¾ mi. The route serves largely the elderly for shopping, meals, and medical trips but it does have a drop-off in Bloomington. Ridership increased steadily in the first year of operation and then stabilized at around 2,200 riders. When deviations are requested, the bus may be 10 to 15 min late and this has occasioned some customer complaints.

CityLink in Abilene, Texas, a 108-sq mi community of 106,000 people has ten fixed routes, nine of which will deviate to either specific places or to destinations requested by a rider. Riders must call to request the service 30 min before boarding but riders also appear to be allowed to request deviations as they board. The system officials report that most deviation requests come from those using wheelchairs; as more users become familiar with the service and the riders become regular, it has become easier to accommodate the deviations. Moreover, many elderly people and those with disabilities who were pre-ADA paratransit users but not recertified as ADA-eligible have switched to the fixed-route service. On the other hand, while the route deviation service is substantially cheaper than providing paratransit services, it is still difficult to operate well and the city is considering either ending it or reducing it.

Another Texas community with roughly the same population, **Wichita Falls**, also offers a system where all routes will deviate upon request. The city has five fixed routes and no paratransit service; all buses will deviate up to two blocks from the fixed route—but only for those who qualify. Riders must call a day in advance to request service, although same day requests will be honored, if possible. The choice of route deviation was consciously made to deal with the paratransit requirements of the ADA. In 1994, of the roughly 120,000 system boardings, more than 4 percent were deviations requested by the elderly and those with disabilities—this reflects a 900 percent increase in ridership by these groups in the 2 years of service.

Ashtabula County Transportation in Ashtablua, Ohio, a city of 22,000 people (in a county of roughly 100,000) operates two point-deviation services in the city; each will deviate one or two blocks to serve specific locations upon request. The hourly "Uptown" route serves shopping centers as well as buildings that house many seniors; the "Harbor East West" route serves residential towers, pharmacies, and medical clinics. The two routes meet at the city center and are timed so that passengers may transfer between the two. The system was adopted in 1992 specifically to replace a previous demand-responsive system. In 1994, roughly 10 percent of the system's 60,000 to 70,000 annual boardings were riders requesting deviations.

Marble Valley Regional Transit in Rutland, Vermont, offers one fixed route in a rural area of central Vermont. The overall goal of the service is to divert paratransit-eligible riders to fixed-route service; the bus will deviate ¾ mi off the fixed route. Elderly riders constitute most of the route's total ridership—system officials feel that roughly 20 percent of the system's annual ridership of 24,000 consists of people requesting a deviation to one of the allowable sites. Officials are pleased with the existing service—originally there were three routes with deviation and this service has been reduced to one route.

The **Cheyenne Transit Program** in Cheyenne, Wyoming, has four flexible routes which allow deviation anywhere; they are considering adding more. The buses are permitted to deviate from the route as long as they arrive and leave the scheduled stops on time—in essence a checkpoint service. In general, the purpose is to pick up and drop off people with disabilities rather than to serve origins and destinations off the route. The service was implemented in May of 1994 to both provide more cost-effective transit service and to do so while meeting the ADA mandates. Currently, the system serves anyone requesting a deviation, although it may be restricted to those ADA-eligible in the future. As with several other services, the deviations have occasioned complaints from other riders who have been delayed.

Rides Mass Transit in Rosiclare, Illinois, in a county with less than 100,000 people, offers what they call quadrant checkpoint deviation. There is a scheduled "fast-track residential route" which operates in four quadrants of the city of Harrisburg; the bus is in each quadrant every 15 min, thus covering the city once each hour. The vehicle travels along a published route, stopping at fixed points but deviating to provide door-to-door service as requested. Riders can only request deviations during the time the bus is in their quadrant; as a result they may have to wait for up to 1 hr for service. This service has evolved from an older demand-responsive system operated by the city. Ridership response has been very positive, and the system is considering adding another vehicle so 30-min service will be available. Although previous demand-responsive users complained when the system switched to this mode of operation, most riders are now very happy with service and ridership has increased more than 13 percent in 1 year.

Route Extension and Optional Stops

The essence of this concept is that the part of route operating in low-density or low-demand areas can be made optional—the bus will not run the route unless requested in advance or by a rider on board the vehicle. The **San Diego Transit System** installed a solar-powered cellular call box at a remote bus stop on a non-productive route leading to Lake Poway, a recreational facility. The bus will not continue to the lake unless a specific request is made. Ridership on the route increased threefold in the first few months of the call box service.

For the 12-month period beginning in July of 1994, there were 1,285 requests for service to the lake and 485 requests from the lake. Today, there are roughly 35 calls per month from the fare box and an equivalent number of on-board requests for the route extension. As a result, the system reduced the number of vehicle trips to the lake by 67 percent and saved approximately $3,500 per year. Most riders are young people attracted by specific recreational events.

The **King County Department of Metropolitan Services** (METRO) in Seattle is testing a new service concept designed to address people's security concerns. Passengers riding at night are allowed to request a stop anywhere along the route.

Service Routes and Community Buses

The best known U.S. service route experience is that of **Madison Mobility** in Madison, Wisconsin, the first community to explicitly adopt the Swedish version of service routes. Over time, the system has significantly changed the service. Beginning in 1992, the Madison Metro Transit System provided service routes in areas not well served by transit and then found themselves also required to provide even more complementary paratransit. Recently, the system reduced the complementary paratransit area to the minimum required, promoted travel training, and begun to apply trip-by-trip eligibility standards. Moreover, they have largely substituted service routes for other traditional services. As a result, they have gone from two to six passengers per hour on the service routes and have reduced their need to subcontract with taxi operators for paratransit services by $300,000 annually.

Madison Mobility has eight service routes, which operate weekdays only, from 7 AM to 6 PM in the community of just under one-quarter of a million. The routes will deviate but only for passengers with disabilities who make the request in advance. All travelers pay the basic system fare of $0.50, with some discounts available.

The **Monmouth County DOT** in Freehold, New Jersey, operates the Shuttle, a network of service routes in addition to operating a fixed-route and paratransit service. The DOT carefully analyzed the patterns of paratransit ridership in determining the routing and scheduling of the service routes. The buses travel a 50-min route with a 2-hr headway, week days only; the schedule is such that three routes provide three round trips per day while the other two provide five trips a day.

The shuttle is available to the general public, although most riders are elderly or those with disabilities. Passengers can board anywhere along the routes, which serve malls, libraries, shopping centers, hospitals, and business areas. The vehicles are routed so that transfers between various routes are possible. Currently, the shuttle carries 20,000 passenger trips per year at a cost of roughly $22 per vehicle hour, substantially less than the paratransit service. Ridership has been steadily increasing; although the system had no data on the number of ADA-eligible riders diverted from paratransit, they believe that they are diverting those travelers and saving money.

The **Broward County Mass Transit Division** (BCt) in Pompano Beach, Florida, initiated a series of community buses as part of an overall route restructuring plan. The BCt ended service to several trailer parks, but paired this with the development of community bus services in conjunction with local municipalities. In 1990, one municipality took part as a trial; today, six different systems participate.

Each participating municipality routes the community bus to provide local services to senior centers, malls, grocery stores, and so forth and to act as feeder or shuttle to region-wide bus services. Most operate on a 90-min loop. The BCt helps each city conduct research and design and develop its own routes and schedules. The BCt leases the vehicles to the municipalities for $10 a year and provides $18,000 per year to maintain each vehicle; the cities pay for drivers and insurance—at an estimated annual cost of $50,000 to $75,000 (although most cities keep costs down by hiring part-time and retired drivers and operating on a restricted schedule). Five of the six systems are fare-free; the remaining city charges $0.25.

BCt has not collected detailed ridership information on the six community bus routes, although it has been higher than that on the traditional fixed route it replaced. Several cities have recently asked to be part of the program. There has been no assessment of the ADA implications of the services.

The **Boulder DOT**, in conjunction with the Denver RTD, began operating "The HOP" in 1994; the HOP has provided Monday through Friday service along a two-way loop, operating on a 10-min headway from 7 AM to 7 PM, serving 43 stops. The DOT is testing an extended service, funded by student and merchant organizations; now Saturday service is available from 9 AM to 10:30 PM, while Thursday and Friday service has been extended to 10:30 PM.

The route was designed around three major trip generators: a shopping center to the east, the Boulder business district to the west, and the University of Colorado campus and its adjacent shopping area to the south. The HOP uses decorated 22-passenger accessible vehicles; with three buses running in each direction, Boulder does not publish a schedule,

knowing that a 10-min headway is realistic. The fare is $0.25, although many people use the ECO-PASS.

The City of Boulder hoped to have 2,000 riders per day; ridership has gone as high as 5,100 and the city predicts that 1996 daily ridership will be 4,300 people (or 1.1 million riders annually)—roughly system capacity. More than 57 percent of all riders are university students; most are not making commuter trips but using the service for shopping, running errands, and lunchtime travel. Twenty-six percent report going to work, 36 percent report going to school, and 35 percent report going shopping. Forty-five percent of riders are men, and 50 percent of all riders are under 24 (roughly 70 percent are under 34).

The system is operating near capacity; part of the success of the service is because of the ECO-PASS (discussed in another section). Surveys show that riders are happy with the frequent and reliable service; 16 percent said that their trips would have been made driving alone if the HOP did not exist while 49 percent of all riders said that the HOP had significantly reduced the number of drive-alone trips they regularly made. There is substantial public demand for additional services.

A service route network in **Madison County**, Illinois, was used to replace off-peak and local services formerly provided by the Bi-State Development Corporation in St. Louis—the service routes cost roughly one-fourth of what the Bi-State service had. Paratransit trips declined by 42 percent when the routes were implemented. Madison County encouraged this diversion by offering travel training and by special marketing and service efforts[22].

A case study of Madison County's 16-route network found that it was linked to a reversal in the general decline in transit ridership seen over the last decade and diverted some paratransit riders. Unfortunately, the decline in paratransit ridership has not lead to a drop in the cost of paratransit service, in part, because the service routes are diverting the least expensive type of traveler with disabilities so that the number of paratransit trips per hour have dropped 44 percent[23]. Again, however, this experience suggests a substantial market among people with disabilities for fixed-route transit service.

TCRP Project B-1 identified 12 North American systems providing service routes in 1993 (out of 309 systems which responded to a survey); the 5 not described in this section are **Pecos Trails Transit** in Roswell, New Mexico, the Minneapolis-St. Paul **Regional Transit Board**, **Lakeland Area Mass Transit District** in Lakeland, Florida, and two Canadian services in Ontario[24].

U.S. examples of service routes in operation longer than 6 months are scarce; therefore, Canadian experiences are of interest. The **Toronto Transit Commission (TTC)** operates five community bus services in addition to a network of increasingly more accessible bus routes and trams, as well as a subway. The community bus routes are focused on areas where there are high concentrations of the elderly and people with disabilities. The routes serve local community destinations—shopping, recreation, and medical—and as feeders to other TTC services, particularly accessible subway stations. The buses operate on a fixed schedule making hourly loops around local areas; the buses run from 9:30 AM to 5:30 PM on weekdays only. The bus may be flagged down anywhere along the route, anyone may ride, and the fare is equal to that on all TTC services.

Ridership has generally stabilized on the community bus routes, with most passengers being over 65. In an on-board survey in 1991 of the first, experimental route, there were one or two passengers in wheelchairs per day. Most users report themselves very happy with the service; there have been continuing requests for longer hours of service as well as weekend service.

TTC began the community bus system with one experimental service; they wanted to see if they could provide an alternative to paratransit for travelers designated as only being able to "use transit with difficulty." The service was a success, diverting several riders from paratransit services and the system was expanded. In 1995, almost 30 percent of the riders on one of the five community bus routes were eligible for paratransit; the least successful service had only 18 percent of its passengers eligible for paratransit services. The first community bus service, which operates 8 hr per day, carries approximately 12 passengers per hour, of whom 3.6 per hour, on average, are eligible for paratransit services. The service considered the least successful carries 5 passengers per hour, of whom less than one-half per hour are eligible for paratransit.

OC Transpo in Ottawa, Ontario, operates three "communibuses." The services are provided in addition to the fixed-route network as a way to improve accessibility for the elderly and those with disabilities. The communibus uses a small low-floor vehicle which has two wheelchair securement areas; it can seat 20 passengers. The routes serve areas where seniors live, as well as hospitals, senior centers, malls, and community facilities; they are designed to come as close to the door of each place as possible.

The services began in May 1992 with accessibility plans calling for the addition of two new routes in each of the next 3 years. Two of the three current communibuses operate on a 1-hr schedule, the third on a 70-min schedule. All three use just one bus and provide service from 8:30 AM to 4:30 PM, Monday through Friday.

The first route, #306, operates on an hourly schedule, although it began with a 30-min headway. The route continues to display increased ridership despite the reduction in service; in 1992, it began with approximately 1,400 trips per month but by August of 1995 it was carrying more than 4,000 monthly trips. Of the 121 average daily trips, 25 (or 21 percent) are taken by people registered for special transit services; and 4 per day are in wheelchairs. Of the total number of daily trips, 8 percent were diverted from cars, 74 percent from regular buses, and 5 percent from the special transit service.

Of all trips on route #306, 13 percent would not have been made without the communibus, almost 30 percent are made by people who have trouble using regular buses (although apparently many had done so), and almost two thirds of the trips are made by people over 55 (28 percent by people over 75). In other words, the route is both diverting riders with disabilities from the special transit service—and increasing total ridership among people with disabilities and the elderly.

The second route, #356, carries 208 daily passengers, with 2 per day using wheelchairs. Almost 26 percent of all trips are made by people registered for the special paratransit system, more than 40 percent of all trips are made by people who have trouble with regular buses, 24 percent of all trips are made by those over 75, and almost 7 percent of all trips would not have been made without the communibus. Roughly 11 percent of all trips—or 23 per day—are diverted from paratransit.

The third route, #316, is the least successful; it carries 95 trips per day of which 14 (15 percent), are made by people registered for special transit service. Almost all of the trips are made by those over 55, a third are made by people who have trouble with regular buses, and about 8 percent would not have been made without the communibus. This route also illustrates some of the problems inherent in providing this type of service; in 1995 the headway had to be increased to 70 min simply to accommodate the delays created by riders.

BC Transit in Vancouver, British Columbia, operates the "handyRoute," a door-to-door service which parallels the fixed-route services. It runs for 12 km in residential neighborhoods, serving destinations of interest to the elderly and those with disabilities. It was begun as an experiment designed to divert riders from the more expensive paratransit service; the specific route was chosen after four possible routes were evaluated for their potential in reducing paratransit use among eligible riders. Currently, there are plans to replace traditional, large bus service in several low-density or low-ridership areas with service routes focused on destinations of interest to those with disabilities.

Unlike other service and community bus systems in North America, handyRoute service is limited to only those who are elderly or have disabilities; this has kept ridership levels fairly low. The service is averaging two trips per hour—which is double the productivity of the special paratransit system; this is roughly 9,000 trips annually. The route operates on a 90-min headway, from 9:30 AM to 5:00 PM, Monday through Friday. It connects with other accessible routes in the community at three sites.

Neighborhood and Downtown Circulators/Loops

The **Phoenix Transit System** has operated a downtown circulator called the DASH since 1990. The service was originally funded by downtown merchants and an air quality management grant. In the first 2 years of service the system was fare-free and operated on a 10-min headway on a loop through the downtown and to the state capitol. Ridership peaked at 650,000 per year. In July of 1992, funding was ended and a $0.25 fare was instituted; ridership declined. As ridership declined, the system cut back service and ridership fell again. In March of 1995, the system reduced service still further, only providing service to the capitol during lunch; overall ridership fell from a high of 1,500 riders per day to less than 600, with more than 70 percent traveling at lunch.

VIA Metropolitan Transit (VIA) in San Antonio, Texas, operates several trolleys on downtown streets; each route is a 30-min one-way directional loop. Together, the trolley routes serve all the major hotels and tourist attractions. The services were originally free and carried 12,000 passengers per day; a fare was instituted and then raised twice to its current level—$0.50. The services now carry only 8,000 daily riders, more than 70 percent of whom are tourists.

The **Greater Richmond Transit Company** (VA) operated a fare-free downtown trolley for 18 months beginning in early 1993; the service ran from 11:30 AM to 2:30 PM. In the first year of service, the trolley carried 250,000 passengers; in July of 1994, GRTC imposed a $0.25 fare and ridership dropped in half. The system then cut service, doubling headways from 6 to 12 min and ridership dropped again because the lunchtime crowd abandoned the system. The service was eliminated in July of 1995.

The **Charlotte Department of Transportation** created a City Loop designed to provide inner-city transportation; two vehicles ran the loop in opposite directions for 18 months. Although the route carried roughly 8 passengers per vehicle hour, the Charlotte DOT did not believe that they were new transit riders and discontinued the service.

The **Grand Rapids Area Transit Authority** (GRATA) began two new suburban circulators in March of 1995 using 14 passenger minibuses; the routes are designed to serve various users making local trips as well as linking with regional bus routes. Both routes have two shuttles, each vehicle moving in the opposite direction; it takes approximately 1 hr to complete the loop in either direction. Route 15 serves Kenwood, a rapidly growing suburban employment center, containing two malls, the airport, and city hall. Although it originally started slowly, the route grew rapidly—carrying abut 700 trips per week by May of 1995.

The second route, Route 11, serves two suburban communities southwest of Grand Rapids with service to four major shopping areas and a mix of residential and commercial locations. Route 11 began with and maintained fairly high patronage—abut 850 passengers per week. No information is available about rider characteristics[25].

Long Beach Transit (Southern California) recently implemented a downtown circulator service which now has 1.3 million new boardings a year and which is well used by people with disabilities[26].

Public Demand-Responsive Service, Taxi Substitution, Jitneys

In the last two decades, several small, demand-responsive services have been open to the public, many in California. TCRP Project B-1 found 90 systems in the United States which claimed to provide general public paratransit; however the researchers felt that most of those were not public systems but specialized services in rural areas[27].

With tightening budgets and the coming of the ADA, those systems which did provide general demand-responsive services have either stopped or sharply reduced services. The problem is that most transit systems have never been able to carry more than two to four travelers per hour which makes these services extremely expensive, even when they are substituting for low-volume fixed routes. However, experts maintain that the technology now exists at a price which would allow even small systems to effectively and efficiently provide demand-responsive services[28]. For example, the **Los Angeles Department of Transportation** recently completed a "Smart Shuttle" feasibility study which evaluated the use of advanced transportation technologies in establishing a flexible demand-responsive system. Unfortunately, very few demand-responsive systems have yet adopted such technology.

Some smaller communities have decided that it may be cost-effective to provide traditional dial-a-ride without sophisticated technology. While demand-responsive services are an expensive complement to existing fixed-route services, it may be cheaper to provide only general public paratransit than to provide fixed-route and ADA-mandated paratransit. The ADA regulations clearly exempt non-fixed-route services from the need to provide paratransit service at the level demanded by the ADA; in particular, the general public system is allowed to have capacity constraints*. Therefore, if a community can meet its total transit demands with only one system, it may be able to save substantially.

The **Phoenix Transit System** has had considerable experience with general public demand-responsive services. For almost a decade, the system offered a weekday service in the northern end of the Phoenix area where traditional service was poor or non-existent. Under contract with private transit operators, mini-vans provided service in a 130-sq mi area; riders just called the carrier for taxi-like service, paying the ordinary base fare. Over time, the area became more densely settled, and Phoenix Transit was able to provide fixed-route service Monday through Saturday; so the dial-a-ride service was discontinued. Phoenix Transit does not provide any service on Sundays. Using accessible vans bought by the system, the private contractor provides dial-a-ride services in a nine-zone service area on Sundays.

The base fare is $2.40 with a surcharge of $1.20 for each additional zone. The average trip is two or more zones. Average Sunday or holiday ridership is about 475 people; roughly one-fourth are people traveling between transfer points for one of the seven other dial-a-ride services operated in the region (almost all the large cities in the region offer such a service including Tempe, Scottsdale, Mesa, and Glendale).

Tidewater Regional Transit District (TRT) in Norfolk, Virginia, provides general public dial-a-ride, although only in a 25-sq mi area of its almost 1,100-sq mi service area. Tidewater provides the Maxi-Ride service in five defined service areas, each with one bus. Although the service is generally demand responsive, the bus is timed to be at a transfer point, where riders can transfer to fixed-route services. Each of the five services operates from 6:00 AM to 7:00 PM, arriving at the timed transfer point once an hour. Requests for service can be phoned directly to the bus through a cellular phone, from 1 to 2 hr before travel. The fare is $2.20 or twice the fixed-route fare.

TRT has found that the general public demand-responsive service costs roughly $23 per hour while fixed-route service costs almost $35 per hour. Ridership has fluctuated substantially over the years but has remained stable since 1993. Maxi-Ride carried 78,372 riders in FY93 and 79,655 in FY94. Staff believe that more than 50 percent of all riders are using the system as a feeder to the fixed-route service, rather than as community-based travel. Maxi-Ride productivity in FY94 was 3.5 passengers per hour.

The **Bis-Man Transit Board** in Bismarck, North Dakota, serves a 12-sq mi area with almost 76,000 residents. It has operated a demand-responsive door-to-door service for two communities surrounding Bismarck since 1990; anyone may ride, although riders who are elderly or who have disabilities are eligible for reduced fares. The service is available 7 days per week, 24 hr per day. The fare is $1.25 in town, $2.00 between towns; 24-hr advance reservations are required. The service carries between 450 and 550 trips per day in the summer and 650 and 700 per day in winter; total annual ridership is approximately 143,000.

The **Sweetwater Transit Authority Resources** (STAR), in Rock Springs, Wyoming, serves a county of 45,000 over 10,400 sq mi, operating a demand-responsive service to all eight cities in the region. STAR carried more than 100,000 one-way passenger trips in 1995. The service costs between $29.10 and $31.91 per vehicle hour and carries an average of 5.74 passengers per vehicle hour. Between 1993 and 1994, ridership increased from 6,288 to 8,537 per month, or 35 percent annually.

The **Portage Area Regional Transportation Authority** (PARTA), of Kent, Ohio, operates demand-responsive services in the rural parts of its service area. It allows anyone to ride but requires at least a 24-hr advance reservation; reservations up to 21 days are accepted. The system makes a serious effort to group passengers on a shared ride basis. PARTA also has contracts with social service agencies to provide services to their own clients. Although actual ridership data are not available, the system says that ridership is increasing.

* The system would have to buy accessible vehicles for all vehicles large enough to seat more than eight passengers; moreover they would be required to provide equivalent services to their passengers with and without handicaps.

Community Transit of Sisseton, South Dakota, operates a paratransit system which serves special schools, medical facilities, stores, and even casinos in an area of under 30,000 people. Anyone may ride, although the system was originally devised for the elderly; 24-hr advance reservations are required although the system will attempt to do real-time dispatching if possible. The previous system attempted to serve employment trips but had very low ridership. Currently, Community Transit carries 94,000 one-way trips annually.

Ozark Regional Transit in Springdale, Arkansas, provides a curb-to-curb public dial-a-ride service to four counties, covering almost 3,000 sq mi and 241,069 people; service is provided within zones through which the bus circulates. The basic demand-responsive service has been in effect since 1973 but has been changed to respond to new demands. Eligible riders may request door-to-door service. The system operates at four to five trips per vehicle hour, fairly high for such services. All riders must request service the day before travel, although same-day medical trips will be accommodated and subscription trips may be requested; most are during the morning peaks. Ridership has been increasing rapidly; between 50 and 100 people each month request certification for door-to-door service. Staff believe that 70 percent of all system riders are either elderly or have disabilities.

The **Metropolitan Transportation Authority** (Houston Metro) has developed a jitney-like service—"FasTrak"—initially designed to complement the fixed-route system along heavily traveled corridors; eventually it may be used to replace unproductive services. FasTrak vehicles are owned and operated by private entrepreneurs who shuttle along Metro's regular bus routes within designated service areas; riders may flag the FasTrak vehicles anywhere along existing routes and they may be dropped off anywhere within ¼ mi of the route. FasTrak vehicles accept no pre-arranged trips in order not to compete with regular taxis. Metro pays each operator $25 per day for each vehicle fielded; the operators set their own fares—which must be published and posted; the operator keeps all the fares and must provide service at least 6 hr per day.

The FasTrak service began in mid-1995 with about 1,600 daily riders in the Westheimer corridor; it stabilized at 1,200 to 1,400 riders per day, or roughly 35 trips per vehicle shift, when Metro was forced to terminate service because the original contractor was not making a profit. MetroService is now in the final stages of contract negotiation with another contractor for service designed to be re-introduced in April of this year. If the FasTrak service is successfully re-introduced, it will allow Metro to trim some peak service; in the second phase, Metro plans to eliminate service in several corridors.

A 1992 study described the private jitneys which carry roughly 500,000 per day in the **Miami** area, or roughly 24 percent of the number of riders carried by Metrobus. An Urban Mobility Corporation study concluded that the jitneys had developed their own markets and were not diverting existing riders from the bus system. Many drivers are Haitian, Cuban, or Dominican immigrants who target services to their own communities; there is substantial evidence that riders prefer to travel with people who speak their language and are known in their respective communities[29]. When Hurricane Andrew destroyed many buses and disabled a host of transit services, the 400 jitneys in the area were pressed into "legal" and even traditional transit services.

Smaller Transit Vehicles

The **Port Authority of Allegheny County** (Pittsburgh) initiated a 1-year demonstration of the effect of using smaller transit vehicles in older neighborhoods. PAT substituted 24-passenger vehicles for the larger 40-ft-long coaches on six non-productive routes, each of which fed into a main trunk line at two transfer points. After the experiment began PAT reduced service to 1-hr headways; despite that, ridership on the routes in question more than doubled.

The British also have solid evidence that using smaller vehicles can increase ridership. After privatization of transit, many private bus companies began running small vehicles along routes formerly served by full-size and even double-decker buses. Ridership increases were substantial but it was not initially clear that the increases were because of vehicle size because the private companies also offered different headways, and so forth. However, ridership grew so rapidly that the bus operators replaced the smaller vehicles with full-size coaches—and ridership dropped, sometimes substantially. It became clear that small vehicles were simply more attractive to riders like the elderly, those carrying shopping and packages, and those accompanied by young children, particularly in strollers or prams.

Concepts Which Make Transit Faster or More Direct

HOV Lanes, Express Buses, Park-and-Ride

High-occupancy vehicle (HOV) lanes give priority to buses, making them faster than adjacent lanes of auto traffic. HOV lanes are often served by express buses, that is, buses which make limited or no stops before reaching their final destination. Both HOV lanes and express buses are often served by park-and-ride facilities. The actual effect on net system ridership of any of these services is not fully known; that is, these services may simply divert riders from existing routes.

For example, a study of the HOV lanes on **Minnesota's I-395**, which opened in fall 1992, found that in the morning peak (1) the use of the adjacent park-and-ride lots increased more than 200 percent, (2) the number of person trips on the corridor increased 57 percent—most were in the HOV lane, and (3) transit ridership went up 126 percent. But the study also found that person trips decreased 41 percent on adjacent routes and that transit increase might be the result of improvements in feeder bus services (rather than the

HOV lane itself) and might have come at the expense of other transit routes in the area. The study concluded that, ". . . [C]hanges in ridership should be evaluated on a service area basis rather than a linear corridor basis."[30]

Even when there is positive effect on transit, that effect may be diluted because HOV lanes also serve car and vanpools. For example, **Community Transit** (near Seattle) found that express ridership dropped significantly in 1992 when the definition of carpool for HOV lane use dropped from 3 to 2 passengers per car. At the same time, however, CT's express commuter services along I-5 to downtown Seattle are the most successful in the system, because this is one area where transit can be competitive with the private car.

The I-66 HOV facility inside the Capital Beltway had a similar experience. In March of 1995, the definition of a carpool was changed from three to two riders as a 1-year test. The **Virginia DOT** (VDOT) evaluated the test and found that transit ridership in the lane dropped by 23 percent in the AM peak period or 3 percent daily. During the same year, other regional in-bound buses slightly increased transit ridership as did the commuter rail line, although total transit ridership in the I-66 corridor remained the same. It seems clear that the substantial drop in the HOV lane was because of the increasingly preferential treatment of small carpools, especially because congestion went up only very slightly on I-66 and accidents actually went down significantly.

The **Denver RTD** recently completed HOV lanes on I-25 and US 36, which provide suburb to suburb service as well as service to downtown. HOV lanes have decreased transit travel time by 20 min in the peak, 7 min in the off peak, and up to 20 min in bad weather. While ridership on the express buses using the HOV lanes was initially encouraged by free fares, ridership has been high even after fares were introduced; the express lane on US 36 is credited with increasing bus ridership by 38 percent and park-and-ride use by a comparable amount. The new ridership is not from among groups generally more likely to use transit—HOV riders tend to be high-income managerial professionals.

The **Charlotte Department of Transportation**, in conjunction with Rockhill, South Carolina, and the states of North and South Carolina, implemented a limited stop service between Rockhill, a suburban bedroom community, and "uptown" Charlotte, in the morning and evening peaks. The objective was to have 200 passengers per day; today the route carries 150 on four vehicle trips and the numbers are growing. The Charlotte DOT has decided to keep the service and considers that it keeps more than 100 cars out of the city each day.

The **Santa Monica Municipal Bus Line** (the Big Blue Bus Line) provides a significant amount of express or freeway service from the city of Santa Monica into downtown Los Angeles during peak hours, carrying roughly 2,000 riders per day.

Foothill Transit, serving the San Gabriel Valley portion of the Los Angeles region, has implemented several productive express services. In fact, express commuter ridership accounts for more than half of total system ridership and has been growing; total boardings on express routes rose 88 percent between FY92-93, when coupled with a 67 percent increase in revenue vehicle hours and a 59 percent increase in vehicle miles.

Two Foothill express routes are the most effective in the system; one operates on the freeway directly to downtown Los Angeles, the second links more distant areas. In 1991, Foothill Transit implemented Route 690 providing peak-period service between Montclair and Pasadena—the first commuter express bus service in the network not focused on downtown Los Angeles.

The **Harris County Metropolitan Transit Authority** (Houston Metro), in conjunction with the Texas DOT and the City of Houston, operates an express bus serving a park-and-ride lot for the annual Houston Livestock Show and Rodeo, one of the largest livestock exhibitions in the world. Nearly two million spectators attend in a 2-week period; because most arrive at the Rodeo grounds 60 to 90 min before opening and leave together at closing time, the event causes every road and freeway in the area to come to a standstill. Moreover there are only 14,000 parking places at the Astrodome, the actual site of the rodeo performances. By 1987, the average spectator could wait several hours in traffic to get into the Astrodome area.

In 1988, the Rodeo Express was initiated on a trial basis to shuttle patrons to and from a single remote parking lot at an underutilized mall parking lot a few miles from the Astrodome; the fare was $0.50 and the Rodeo agreed to pay Metro for all costs incurred. Because football and baseball shuttles had never attracted more than 500 people (the Astrodome is where the Oilers and Astros play), the organizers were uncertain of the response. By the end of the first year, the shuttle was averaging 2,500 patrons daily. Between 1988 and 1995 the shuttle experienced dramatic increases in ridership; in 1991 it was carrying just under 10,000 passengers per day and in 1995 it carried an average of 17,000 trips per day—or about 16 percent of those attending the Rodeo. There are now six separate park-and-ride lots throughout the city; with a $2.00 fare the service pays 77 percent of its full cost with the Rodeo subsidizing most of the rest[31].

The **Greater Cleveland Regional Transit Authority** (GCRTA) also recently began park-and-ride service to a new sports and entertainment complex which opened in April 1994. The Gateway Center is 1/4 mi from the main intermodal transfer hub of the system's buses and rapid transit and is connected by a $11 million walkway. At the April 4, 1994, opening of the ballpark at Gateway, the express buses carried 18,000 people or 44 percent of those attending the Cleveland Indian's game—double the original projections. In the 9 months of service in 1994, the express buses provided 830,000 passenger trips to the Gateway Complex[32].

A Georgia Institute of Technology study of **MARTA's** (Atlanta) special events ridership found that special events

riders were very different from daily riders; for example, only 19 percent of those using transit to attend basketball games were regular transit riders. Special events riders were wealthier than regular riders—nearly half earned more than $35,000 yearly compared to under one-third of regular riders. Special events riders were more likely to be white males than were regular riders (33 percent versus 15 percent) and more likely to be white females (50 percent of concert goers, for example, versus 12.5 percent of regular transit users). The study concluded that special events create new and different markets for transit operators[33].

The addition of parking facilities can also increase commuter ridership. Another Georgia Institute of Technology study found that suburban transit riders were especially sensitive to the supply of park-and-ride lots; middle- and high-income suburban workers were not likely to use shuttle or feeder buses if they could not drive to the station or stop[34]. **METRA**, the commuter rail system serving downtown Chicago, increased transit ridership when new parking was added at selected stations, although the effect varied with distance. At METRA stations within 25 mi of downtown Chicago, between 12 and 16 percent of new parkers were former drive-alone commuters; at stations further from Chicago, between 39 and100 percent of new parkers were former car drivers[35].

However, the **Broward County Mass Transit Division** operates a park-and-ride shuttle which has the lowest number of passengers per mile in the system—rarely more than 6 or 8 passengers per vehicle trip. However there is only one trip run in the morning and one in the afternoon so the limited frequency may constrain ridership below what it would be in the face of more service.

Route Restructuring

Surveys conducted by transit agencies reveal that people are dissatisfied with routes and frequencies, service during evenings, the number of transfers, and the long waits for transfer connections. To better serve existing and new markets, systems can restructure their routes, services, and schedules. These service concepts can include providing more direct routing by eliminating branches, connecting radial routes to eliminate the need to transfer at terminals and delivering patrons closer to their CBD destination, eliminating routes that are too close, and duplicating routes to provide more frequent service on route segments where vehicles are overloaded. It can also provide more consistency in both the span of service and clock headways so that schedules are easier to remember.

Transit agencies can restructure existing service to provide more frequent and reliable service as well as to introduce less traditional modes for areas where traditional service does not exist or must be withdrawn. Route restructuring responds to the fact that land use in American cities is constantly changing: people are mobile, jobs are flexible, and neighborhoods are buffeted by social shifts. But transit routes remain stable over long periods requiring travelers to adapt to them. This rigidity may prevent transit agencies from better serving several potential groups of riders, including those living in older residential neighborhoods where density may be increasing.

The suburbanization of employment is often associated with very-low-density development but it may also result in some very-high-density suburban nodes. Although route restructuring is normally directed to routes serving downtown, suburban nodes can also be the focus because these centers are increasing their share of commercial activity. The "new" routes can include through connections to suburban centers without transferring, which allows members of low-income households to reach a wider selection of public services. For example, the **Hartford DOT** has been restructuring service to deal with the fact that more than 40 percent of system riders no longer have a CBD destination and that ridership on express buses from the suburbs to the CBD has been falling by 3 percent or more each year for close to a decade. Instead they have been redirecting existing radial routes to reach suburban shopping malls and large retirement communities.

In addition to removing redundant or ineffective services, route restructuring as a concept implies providing a package of new or better targeted services—although most have been tried individually by systems for years. The most common individual service concepts are interlining, developing new or modified crosstown service or suburb-to-suburb service, initiating timed transfers, and constructing suburban transit/transfer stations—all discussed in this subsection.

Route restructuring can also include implementing feeder services, express routes, park-and-ride facilities, downtown and neighborhood circulators, and reverse-commute services, all of which are discussed in other sections of this report. In the following subsections, the ridership response to individual service changes which systems have implemented and the ridership experiences of systems which have implemented whole sets of these changes either throughout their service area or in one section are described.

Individual Service Options

The **Capital Metropolitan Transit Authority** in Austin, Texas, implemented a cross-town route in 1992; it travels through large population centers, including a high concentration of university student housing and high-technology employment; the middle of the route has low-income housing projects and several retail areas. The service has experienced continuing growth and is a stable route within the system although detailed ridership data are not available. At the same time, Capital Metro has not been successful with other suburb-to-suburb routes.

The Boston **Massachusetts Bay Transportation Authority** (MBTA) added three limited-stop crosstown routes to better serve students, visitors, and staff at several hospitals and medical complexes as well as local universities. Although the services were not designed to actually improve ridership, but rather to provide better services for existing riders, one-third of the 7,500 daily riders are new.

The **Charlotte Department of Transportation** (Charlotte, NC) recently added a crosstown route which was designed to better connect the northern side of the city without requiring travelers to go through the traditional core of the city to go from northwest to northeast (where the university is located). The route is considered effective because it already carries more than 13 passengers per vehicle hour.

The **Capital Area Transportation Authority** (Lansing, Michigan) has created a system of interlined routes by renumbering buses as they pass through the downtown area and continue on. This has allowed 25 percent of riders to travel through downtown without transferring.

Foothill Transit, serving the San Gabriel Valley portion of the Los Angeles region, began operation in December of 1988 by taking over and restructuring services formerly provided by the regional carrier, SCRTD, now the Los Angeles MTA. Foothill began new express services and routes to areas not formerly served and reorganized service to connect with the transit operators serving nearby Riverside and San Bernardino counties at a suburban transfer center. In fact, the system is developing a network of eight timed transfer centers. Foothill's ridership has increased each year since 1988; between 1992 and 1994, ridership rose from 6.9 million passenger trips annually to 11.1 million—or almost 61 percent in 3 years, with the average number of passengers per vehicle hour ranging from 27.2 to 28.0.

In 1993 and 1994 the **Central New York RTA** (Centro) in Syracuse, New York, took over a bankrupt private bus operator providing service among three small nearby cities—in essence suburb-to-suburb travel. Centro changed the service from local to express, modified schedules, and integrated the services with their own, allowing for better connections. Ridership has increased more than 30 percent on the routes in question. In response to the move of a large employer from the CBD to the suburbs, Centro also developed a new crosstown route providing service to employees at that major employment site (without any subsidy from the employer). One bus carries 35 to 40 riders and travels directly between two suburban areas without requiring riders to go through downtown.

A 1993 study of transit operators with 50 or more vehicles found that roughly two-thirds reported having some kind of timed transfer or transit center service. Ninety percent of the largest transit systems (those with more than 350 vehicles) used timed transfers. Most of the systems had seen substantial ridership increases within 1 year after implementing such services; **Painesville, Ohio,** had a 40 percent increase in system ridership. Transit ridership went up substantially in the two areas of **AC Transit** (Oakland) where multidirectional transit stations were implemented in 1989. In fact, the system showed a 4 percent increase in overall system ridership between 1989 and 1991 entirely because of the 32 percent increase in ridership in one and the 7 percent increase in the other transfer station[36].

Suburb-to-suburb and cross-town services, interlining, and suburban transit stations operate in several other communities, including **Dallas, Marin County, Denver, Santa Clarita (CA), Westchester County (NY), Allentown (PA), Granite City (WI), Columbus (OH)**, and **San Diego**[37].

System Restructuring

One of the earliest comprehensive system restructuring efforts was undertaken by **Tri-Met** in Portland; they have also provided the most carefully documented case studies of restructuring[38 39]. The system evaluated the consequences of changes in service level, travel cost, and market size at the system, sector, and route level as well as the effect of 81 service-level and 5 fare changes on ridership. The analyses found that there were wide variations in the effect of service and cost changes and that ridership in different sectors and on different routes responded differently to similar changes in the level of service provided. Routes traversing the medium-density suburbs and the central city had the highest response given the percentage change in service.

In addition, Portland found that the effects of variables were not independent. Feedback relationships were identified between transit ridership, service level, fare, gasoline prices, and employment. In addition, the effects of the route restructuring were not instantaneous; ridership increased in some suburban services in the first 5 months while it took 8 to 10 months for urban service changes.

Suburban bus service in the Westside sector of Portland was restructured in June 1979. The new system included four regional routes and eight community routes focused on transit centers in Beaverton and Cedar Hills. Community service within the Westside was significantly increased and service to downtown Portland was increased and travel time decreased. An additional 8,400 riders per day were achieved through this service change. Most of the gain resulted from increased service or was accounted for by the gasoline shortage that occurred 3 months after the service change.

Off-peak, non-work trips increased by 68 percent, however. This was unexpected and created a new market for transit in suburban Portland. Monitoring performance by route has enabled Tri-Met to gradually improve performance. During the initial year, ridership was at 20.11 passengers per vehicle hour. Tri-Met had provided too much service, so they have been gradually reducing service hours to improve service effectiveness. As they have done so, ridership per vehicle hour increased to 26.7 (1982), 27.4 (1985), and 40.8 (1989).

In 1994, the **Sacramento Regional Transit District** (RT) reoriented and restructured service in its South Sector. RT used Census data to screen several sectors and chose to focus on the South Sector because both population and the number of households were increasing. In addition, this segment linked the downtown where governmental and commercial employment is concentrated with the emerging health services complex on the southern margin. A shopping mall that serves as a timed-transfer center, as well as the university hospital, are in this sector.

RT replaced non-productive service with through-routes by combining the most productive segments of existing routes. Streets with heavy traffic which had not previously been served were combined into through-routes with frequent service to major attractors. At the same time, RT abandoned routes which did not meet minimum performance criteria. Finally, RT added a major shopping mall as a transit center for many of the revised routes. Overall, seven routes were substantially changed; however, RT selectively added and deleted service so that the net hours of revenue service remained the same.

The changes generated increased ridership; overall, ridership was 12 percent higher on the restructured routes. However, when controlling for the level of service, ridership per hour increased 1.3 percent on all the restructured routes.

The **Orange County Transportation Authority (OCTA)** (California) began the implementation of a comprehensive set of bus service changes in October 1995. The changes were the result of a comprehensive bus system improvement project which recognized the substantial changes in both population and county development patterns. OCTA adopted a three-tier transit strategy as the permanent framework for providing service.

In the first or base tier, OCTA will operate a grid system of base routes in the areas with high transit use and high population and employment densities. In the second or connector tier, OCTA will use bus routes to link the first tier to the rest of the county, together providing countywide coverage. In the third or support tier, OCTA will offer a "family" of transit support services, including neighborhood circulator routes, express routes on the freeways, shuttle bus routes for Metrolink users, and other less traditional transit services.

New service plans were developed by area of the county. All service plans provide for

- Consistent headways on all routes to reduce passenger wait times, increase passenger convenience, and improve transfer connections;
- Consistent spans of service to ensure that users make roundtrips and to provide a service that is easy to understand;
- Restructured routes and new routes to reduce transfer requirements and times to reduce delays because of circuitous routing and to add service to underserved areas; and
- Upgrading of transit service, including expanding community and express routes, and late evening services to attract commuters and other discretionary users.

Many of the new community circulator routes will be operated with smaller buses.

Unfortunately, OCTA was affected by the county's financial problems and has not been able to implement all the plans. OCTA did eliminate some routes, create several new routes, alter headways to make them more consistent, and put smaller buses into service on lower volume routes. Three new feeder lines were added to serve the newly opened Inland Empire/Orange County Commuter Rail Line, which opened on October 2, 1995. In addition, trips were extended on some existing routes to serve the new stations.

Ridership response to these changes has been high. Ridership was up 8 percent in October of 1995 over the same month in 1994; the November 1995 tally was 10 percent higher than the comparable month in 1994. Some of the increases were part of a general trend toward increased ridership in the area, but the route changes, combined with increased marketing efforts, and the feeder routes to the commuter rail, are credited with attracting the remainder of the new riders.

The **Niagara Frontier Transit Authority** (Buffalo, New York) began a major system restructuring in 1993 designed to simplify the system by eliminating deviations and focusing instead on major transit corridors, while retaining the same amount of service. Included in the restructuring program were six new suburban transit centers, a renewed emphasis on express services from the suburbs to the traditional core (the most successful aspect of the prior network), and reverse-commute services. The reverse-commute routes have been the most successful of the restructured routes so far, with both ridership and passenger miles gradually increasing. Among the least successful new routes are weekend services to suburban shopping malls.

Community Transit (serving Snohomish County, north of Seattle) began a program of local route restructuring in 1992. This involved adjustments to individual routes and schedules and changes in the fundamental orientation of the network. In the South County network, CT abolished two routes and changed most of the remaining routes. In particular, CT established a South County Transit Center west of Highway 99, which eliminated the need to transfer at the Lynwood center for riders traveling to Highway 99 destinations. In 1993, CT began restructuring the North County network; CT eliminated two routes, added two routes, and expanded several more. These changes resulted in a 5 percent increase in overall ridership and an even greater effect on several routes. Ridership response on the two new routes was high and doubled between 1993 and 1994.

The **Phoenix Transit System**, operated by the Regional Public Transportation Authority, operated a grid system which left major segments of the community, including

major employment concentrations, unserved. To address this problem, in March of 1994, the system introduced a Color Line Service designed to serve major employment centers and destinations, such as the airport and Arizona State University (the fifth largest employer in the state). The most productive segments of existing routes were taken, realigned along major transportation corridors, and linked; headways were reduced significantly. As a result, most riders no longer need to transfer and can reach destinations formerly inaccessible by transit. Although ridership has been high on the Color Lines, it has been matched by a roughly equal decline in the older routes on the grid system.

Tidewater Regional Transit in Norfolk, Virginia, introduced a timed-transfer system in multiple phases from 1989 to 1991. All routes and schedules were revised from a radial network to a system of 13 multiple hubs and spokes designed to facilitate transfers, because more than 40 percent of all trips require a transfer, more than half outside the downtown area. From two to six routes meet at one location; there are no transfer fares and no elaborate facilities because passengers do not have to wait long for their connecting bus. As part of the guaranteed connection program, drivers are authorized to wait up to 2 min for the other buses due at the transfer point. TRT has been losing ridership over the last 10 years, largely because it is so heavily influenced by tourism and the actions of the U.S. Navy. However, riders are very satisfied with the Direct Transfer Bus system and it may have helped stem the decline in ridership.

The **City of Los Angeles Department of Transportation** (LA DOT) is undertaking a major study of restructuring bus services in the Westchester, Lennox, Watts, Inglewood area they call "Mid-Cities" which includes Los Angeles International Airport. The LA DOT is attempting to review the existing fixed-route system to make it more responsive to the needs of people in the area. The current bus network is largely a grid system which requires people to transfer at least once to complete trips.

In the past few years, the LA DOT implemented DASH circulator systems and a new limited-stop diagonal service to minimize transfers. At the same time, several buses were rerouted to facilitate access to the new Green line rail system; this move was widely seen as reducing the quality of bus service in the area.

King County Transit (Seattle) recently adopted a 6-year transportation plan which includes a restructuring of existing transit routes. Restructuring will begin with one of nine service areas in September of 1996; four additional areas will undergo restructuring in 1997 and the final four will be done in 1998. The overall goal of the restructuring efforts is to better serve suburban job centers.

Light Rail

In July of 1993, the **Bi-State Development Agency** in St. Louis opened MetroLink. In July of 1993—before all the stations were in operation—the system was carrying just over 44,000 trips per weekday and more than 50,000 trips per weekend day. Much of the weekend traffic is attributable to two specific trip attractors—Busch Stadium (where the Cardinals play) and the Casino Queen, a new riverboat gambling establishment. While there are no figures available on diversion from other transit, bus ridership also went up 36 percent in the 12 months after the rail system opened (from 125,000 to 169,000 trips per month). There are reports that, since MetroLink opened, business has also increased at St. Louis Center (a large shopping center) and Union Station (a festival mall).

The **Sacramento Regional Transit District** (RT) opened its light rail system in April of 1987; it became fully operational with two segments in 1988. The system is organized to provide timed transfers between modes. Ridership grew quickly; in FY89, the system carried 16.7 million trips per year but ridership increased more than 26 percent to 21 million trips by FY93. Since 1993, however, light rail ridership increases have come at the expense of bus patronage. During 1995, light rail ridership was increasing at 3.1 percent per month while ridership on RT buses was dropping 2 percent overall per month. In the summer of 1995, RT introduced a bus to parallel the Orange Vail Citrus Heights light rail route during peak hours; it has a travel time 15 min less than the light rail system.

RT also recently added two new light rail stations which have contributed to the monthly ridership increases. Two stations were added to the Folsum line, one at 39th Street and one at 48th Street. The 39th Street Station is on the northern fringe of the University of California Medical center; there is also additional hospital construction in the area. The station includes a turning loop for a free shuttle bus which serves the medical center. Although ridership increased substantially when these stations were opened, ridership on the buses serving the same area fell.

The **Niagara Frontier Transportation Authority** (NFTA, Buffalo, NY) has had a 6.5-mi light rail line since 1985 with a barrier-free self-service honor system. Although the system was carrying 30,000 passengers per day in its initial year of operation, ridership has fallen to 27,000 daily. In 1993, NFTA began implementing an 18 month long route restructuring to create greater ridership in several transportation corridors, including the rail corridor.

Heavy and Commuter Rail

The **MBTA** has been experiencing substantial ridership gains on its commuter rail services—gains not achieved at the expense of bus ridership. Commuter rail travel has been growing at about 8 percent per year for the last 3 years; system personnel believe this is because of a shift of population to the suburbs, but suburbs served by rail where residents prefer rail to bus. The MBTA is adding two new commuter rail lines; the 1994 extension of the Framingham line to Worcester, a previously unserved city west of Boston, immediately attracted 150 to 200 daily riders.

Today with limited service (six trips per day) the Framingham line carries 800 passenger trips—who must all be new transit riders by definition. The Middleborough-Plymouth line (scheduled for completion this year) is expected to serve just over 6,000 daily trips with slightly less than half being new transit riders. At the same time, MBTA is resisting pressure for more rail lines because express bus service is more convenient in many places than rail allowing travel to Boston's core without making riders transfer.

In October of 1995, the **Southern California Regional Rail Authority** (SCRRA) opened a 49-mi suburb-to-suburb commuter rail link, dubbed the Inland Empire/Orange County Line; it parallels the US 55 and 91 freeways in Riverside County and then travels south along US 5 to Irvine. In the first month of operation, there were 650 trips per day; in March of 1996 there were roughly 1,000 trips per day. Surveys indicate that 70 percent of the rail system's riders were previously drive-alone commuters.

In 1994, the **Chicago Transit Authority (CTA)** opened the Orange Line in the Southwest corridor of the service area, connecting the downtown Loop with Midway Airport. The new line connects with other CTA lines and provides 40 percent faster service than the express buses formerly serving the area—when the line opened, the routes were restructured to reduce duplication and to encourage transfer to the rail system. In October 1994, the line had 37,500 trips per weekday.

A May 1995 on-board survey found that 27 percent of all Orange Line riders were Hispanic, 13 percent were Black, and 55 percent were White. Fifty-nine percent of riders were women. Roughly one-third of all riders made more than $50,000 per year while 37 percent made under $30,000 annually; at the same time, only 11 percent of riders had no vehicle available for the trip while more than half of all riders had two or more vehicles available. The bulk of riders were younger than 34; only 8 percent were over 55 while 20 percent were under 18. Of those riders under 18 years of age, 52 percent were Hispanic while 19 percent were Black. Those younger than 18 were significantly more likely to use the Line five or more times per week[40].

The May 1995 on-board survey also showed that most riders came from households with four or more members; 29 percent came from households with five or more members. More than 56 percent of all riders were commuting to work while 15 percent were going to school; only 3 percent were going shopping and 4 percent were going to the airport. Many of those using the Line to shop were older (over 55) and had very low incomes.

When the line opened in 1994, many rail riders were former bus passengers—65 percent were diverted from the express buses formerly serving the area—but the new line clearly diverted non-transit users. Roughly 11 percent of the remaining riders drove for the trips in question before the opening of the Orange Line. The 1995 survey showed that 54 percent of riders had made the same trip before the Orange Line; of those, 26 percent were former car drivers or passengers while an additional 4 percent had previously taken a taxi. Most diverted riders had previously taken either a CTA or PACE bus (62 percent) or another rapid rail line (12 percent) or the METRA commuter rail line (2 percent).

Most of the auto users diverted were White (66 percent), male (53 percent), and under 34 years of age; two thirds made more than $30,000 and more than one-third made more than $50,000. More than 90 percent of those diverted to the Orange Line had one or more cars available for the trip; one out of four diverted passengers had three or more cars available for the trip.

In 1989, the **Tri-County Commuter Rail Authority** (Tri-Rail) opened a 66-mi commuter rail system in southeast Florida (Broward, Dade, and Palm Beach counties). In March of 1991, when an on-board survey was undertaken, Tri-Rail operated 15 stations, running 20 trains each weekday and 18 trains on Saturday. In September of 1991, the system carried an average of 6,700 trips per day. The on-board survey showed that the average weekday rider was White, between 23 and 34, and making between $20,000 and $40,000; almost all riders were new to mass transit and traveling an average of 34 mi[41]. Thus rail passengers were substantially different from bus riders in the area—who were largely female, often elderly, with low income and making much shorter average trips.

An interesting feature of Tri-Rail is that, unlike other commuter rail systems, it does not go to a traditional downtown (Miami); rather it serves employment and residential markets along the long rail corridor. As a result, almost one in five trips is not a work trip and is made in the off-peak.

The **Long Island Railroad**, now managed by the New York MTA, has been losing ridership at 1 percent per year. However several individual services have gained ridership because the system was able to significantly reduce travel time. In 1987, the Ronconcomo Line, at the eastern edge of the LIRR service area, was electrified; this reduced travel time to New York City to 60 min (from 90 min) and eliminated the need to transfer at Jamaica Station. These changes resulted in a tremendous increase in ridership on this one line. The railroad is purchasing dual-mode trains (diesel and electric) in order to cut time and the required Jamaica Station transfer on the Port Jefferson line.

METRA, the commuter rail system serving downtown Chicago, increased transit ridership substantially between 1983 and 1993. Ridership increased almost 29 percent or roughly 60,000 trips per day. Ridership increases were highest among those living farthest from the Chicago CBD; ridership among those boarding at stations 30 mi or more from central Chicago increased almost 74 percent while ridership increased "only" 44 percent among those living within 10 mi of the CBD. Most riders accessed METRA by driving alone (55 percent) or being dropped off (13 percent); less than 5 percent transferred from another transit mode. Of course, the further away from the CBD a rider boarded, the more likely he or she was to drive alone to the station; more than 70 percent of those living more than 30

mi away did so. The further away someone lived from the CBD, the more likely he or she also was to get to the station by bus[42].

Low-Floor Buses

There are many stories both in North America and in Europe of the ability of low-floor buses in regular fixed-route service to increase ridership among many kinds of riders[43,44]; in Europe, for example, some systems report a belief in increased ridership by women with small children and baby carriages[45]. The UK researchers documenting the British experience with low-floor buses note that one of the major reasons for implementing such vehicles is to increase ridership by the elderly and those with disabilities[46]. However, the actual effect of low-floor buses on ridership has been far harder to document.

Calgary Transit tested 22-passenger low-floor buses on a downtown shuttle route. A survey of passengers indicated a 19 percent increase in ridership and a 95 percent customer satisfaction score.

A TCRP study reported anecdotal stories of greater use of low-floor buses by those with disabilities in **Ann Arbor, Michigan**, but noted that these assertions could not be supported by either decreased paratransit ridership or increased fixed-route ridership. However the Ann Arbor Transit Authority was only operating 10 low-floor buses at the time of the study and, because they were unsure of the operational implications, they were not widely advertising the services or taking any steps to encourage diversion from paratransit[47].

Concepts Which Make Transit Cheaper for the Rider

Fare Incentives

Pricing is an important tool for distinguishing among markets of users. By establishing fare categories, transit systems can respond to the fact that different market niches (e.g, commuters, students, immigrants, and older people) have different responses to the cost of transit service. This opens the door for marketing strategies which respond to transit's highly segmented market.

There has long been substantial discussion of the effect on transit ridership of reducing fares and making fares easier to pay. A 1991 APTA study found that transit's fare elasticity—or people's responsiveness to changes in the price of a transit trip— was fairly low: -0.40; this means that for every 1 percent increase in the price of transit there would be a 0.4 percent decrease in the number of rides purchased. It also means that increasing fares will lead to higher total revenues, because fares will go up faster than ridership will go down. The study also found that elasticities varied by city size and by peak and off peak. Transit riders in areas under one million were more responsive to fare changes as were peak-period riders[48].

The elasticities computed in the APTA study should, in theory, also apply to reductions in fares designed to increase ridership; that is decreasing fares by 10 percent should increase ridership on average by 4 percent. However, almost all of the 52 systems which APTA studied had raised fares; it is not clear if rider response really would be the same to decreases in fares—they may move faster or slower. Moreover, if the elasticity figures were correct, the transit system would actually lose money although it increased ridership, simply because ridership would not increase as fast as fares would drop. In addition, one would expect different kinds of riders to have different responses to price incentives; the challenge of using fare incentives is to target the right price to the right passenger.

That larger cities have fairly low fare elasticities may explain why the **Massachusetts Bay Transportation Authority** (Boston) reported no effect on ridership from their 20 percent increase in fare in September of 1991 (the basic fare went from $0.50 to $0.60). However, other factors are at work. The **Broward County Mass Transit Division** also raised fares in April 1995 without reducing ridership; in fact there was a 14 percent increase in youth ridership and a 4 percent systemwide increase. Broward County attributes this, in part, to the aggressive marketing of monthly and weekly passes; the passes are widely available and may be purchased by government employees as a payroll deduction. **Community Transit** also raised fares in 1991 but ridership continued to grow.

On the other hand, the **Hartford DOT** has increased fares four times since 1991; each increase has had an adverse effect on ridership. The first fare increase in 1991 generated the most noticeable drop in ridership. Likewise, the **Capital Area Transportation Authority** (Lansing, MI) has increased fares twice since 1991, resulting in an annual ridership loss of 8 percent.

A 1995 study of deep discounting of multi-ride tickets—that is giving a substantial reduction on the purchase of ten or more tickets—found that 30 transit systems had adopted this approach in just the last 8 years. Although local experience varied, the study concluded that "... it is generally accepted that an effective Deep Discount plan can raise revenue by 15 to 20 percent without losing riders, and it has sometimes built ridership by a few percent."[49] The authors of the study concluded that infrequent riders rode more once they purchased multi-tickets even though they were less sensitive to price discounts than regular riders.

As proof of this interesting observation, Oram and Stark evaluated the **San Francisco Bay Area Commuter Check Program**; commuter checks are bought by employers and given to employees as a tax-free benefit which they redeem when buying tickets and passes. Checks are available in two denominations: $20 and $30. Their survey of 239 employers found that roughly a third of employee respondents

increased their use of transit for work and occasionally non-work trips; the average increase was 3.24 transit trips per week per check recipient. While these data show that the fare subsidies had substantial effects on traveler behavior, there was no correlation between the size of the subsidy and travel behavior—that is, those getting the smaller subsidy were actually more likely to use transit more often than were those getting the larger subsidy (35 percent versus 30 percent) even when controlling for location in the community (as a proxy for transit access)[50].

The authors conclude that infrequent users could substantially increase their use of transit while those very dependant on the mode already could not travel much more regardless of the subsidy. If true, these observations suggest that enrollment in a subsidy program may have a greater effect on increasing transit use than does the actual amount of the subsidy. For example, a 1994 study by Charles River Associates of New York City's fare subsidy voucher found that the number of new trips per $15 of subsidy fell after employees began to receive more than $15 of subsidy[51].

The **Champaign-Urbana Mass Transit District** (MTD) increased base fares from $0.50 to $0.75 in August of 1992; at the same time, MTD introduced discount tokens at $0.50 apiece if bought in lots of ten. Both ridership and revenue went up, probably indicating that people sensitive to fare increases simply bought discount tokens and even those not sensitive used transit more once they bought the tokens.

The **Denver RTD** and the **Boulder DOT** have developed individual ECO-PASS programs, an employer-based pass begun by Boulder and then taken regionwide by the RTD. Companies must enroll all their employees to use the pass program which provides unlimited access to bus and light rail service at a cost of $40 to $45 per year per employee. Pass holders also have unlimited use of a guaranteed-ride-home program with a 100-mi one-way limit. The price of the pass is based on the pricing structure in the area concerned; Denver is the most expensive while outlying areas with limited transit service are the cheapest. Currently, 25,000 students at the University of Colorado use their IDs to obtain the ECO-PASS which is subsidized by the university. An additional 15,000 workers use the pass provided by the Denver RTD.

When a new company joins the program, transit ridership at that location increases from 50 to 400 percent. Overall, in the 6 years since its inception, ridership associated with pass use has increased 161 percent. Although the success of the program has been attributed to environmental awareness as well as the parking problems of the participating employers, the pass itself is attractive to several riders. The DOT staff report that employers often indicate their participation as an incentive in job advertisements.

The **Washington Metropolitan Area Transit Authority** (WMATA) in Washington, D.C., created a workplace transit benefit program they call MetroPool. MetroPool is designed to be used by corporations, federal and military agencies, nonprofit organizations, and businesses. It encourages employers to make transit vouchers available to employees at work. Employers can purchase Metrocheks in preset denominations and distribute them monthly to their employees who use public transit. A Metrochek is a commuting card created for the workplace. It looks and works like a Metrorail farecard and is accepted by 49 different transit systems in the Washington area, including commuter trains, Metrorail, Metrobus, and qualified commuter bus and vanpool systems.

The **University of Washington** (Seattle) developed a special commuter program in conjunction with **Seattle Metro** and **Community Transit (CT)**; in 1991, the university implemented a package of transit and ridesharing options tied to a U-PASS. The U-PASS was offered to students at a substantial discount (initially $20 per quarter for students and $27 for faculty and staff) and allowed ridership on various transit modes. The program included increased transit services, ridesharing matching, guaranteed rides home, and merchant discounts; campus parking rates were also raised 50 percent (from $24 to $36 per month). Within 2 years, roughly 80 percent of the 50,000 people on campus had bought a pass.

Between 1991 and 1993, total campus ridership on Seattle Metro's services grew almost three million trips per year, or 60 percent. Community Transit reported an immediate 22 percent increase in ridership on its weekday routes to campus. Overall CT has almost 2,500 campus-based boardings each day—roughly 12 percent of all daily boardings in the system. Ridership has been increasing steadily; between 1993 and 1995, university boardings grew almost 7 percent. CT's university services have the highest number of passengers per hour in the system—31.8 compared to the system average of 21.8.

Doing away with transit fares to increase ridership is a topic which constantly engages the public's interest. The **Capital Metropolitan Transportation Authority** in Austin, Texas, is one of the largest systems to ever introduce a totally fare-free system; begun in 1989, the free fare remained in force for 18 months. It was ended prematurely because of substantial problems with homeless people, vandalism, and increased crime aboard the vehicles; the School District formally requested that Capital Metro end the policy because it was encouraging truancy. Ridership did increase remarkably—from 70,000 to 130,000 boardings daily. Capital Metro did not return to their former fare policy when they returned to a paying system; they sharply reduced the price of discount passes and instituted a flat $0.50 cash fare.

The Austin system has no data on the type of rider attracted by the free service. They feel that the actual number of riders did not go up substantially; rather they think that current riders simply rode more frequently. Anecdotal stories, however, report decreased ridership by regular commuters who were upset by vehicle crowding, the rowdiness of groups of teenagers, and the security problems possibly posed by large numbers of homeless people who were riding.

In January of 1994, Capital Metro also introduced a reduced weekend rate of $0.25 for a 6-month demonstration period; the fare was targeted at large families and was designed to increase weekend ridership. The system did increase ridership, which was maintained after the end of the special fare trial period.

The **Greater Bridgeport Transit District (GBTD)** provides fixed-route and paratransit services to the Connecticut communities of Bridgeport, Fairfield, Stratford, and Turnbull, with a combined population of 276,509. In 1993, GBTD adopted a promotional campaign that included free fares on fixed-route service and a substantial fare increase on paratransit. This month-long campaign was so successful that the free-fare program was extended through 1993 and 1994. Ridership increases have been significant.

The **Port Authority of Allegheny County** (Pittsburgh) offers barrier-free entry at all three rail stations in the downtown area as well as free entry to the bus system. The "Three Stops for Free" program is well utilized by people working and shopping in downtown, and it has been a great selling point for the convention and tourist trade. As a result, all trains operate at full capacity in the core.

PAT also has a special Summer Pass Program for summer school students paid for by the City of Pittsburgh; although the program was targeted at teenagers, the actual ridership response has been from 8- and 9-year-olds. In the first year of the program, Summer Pass holders made 95,000 trips; in 1994, they made 225,000.

The **King County Department of Metropolitan Services** (Metro) in Seattle allows all transit services in the downtown area to be boarded for free until 7:00 PM. Originally designed to reduce dwell time, the free ride concept has been modified to eliminate the problem of homeless people riding at night—now service is no longer free after 7:00 PM.

Several transit systems which implemented fare-free trials were successful in increasing overall transit ridership, including the **Worchester Regional Transit Authority**, the **Riverside (CA) Transit System**, the **Santa Cruz (CA) Transit System**, and the **Hillsborough Area Regional Transit (HART)**[52].

The **Niagara Frontier Transportation Authority** (Buffalo, NY) reports that 30 percent of their ridership are public school students in grades 8 through12. About one-third of the students use a student pass which has a picture ID; these passes are purchased from the transit system by the school district and are valid only during school hours and rides from home to school and back again.

Several transit systems offer free fares to those in wheelchairs or certified as eligible for complementary paratransit in order to increase use of accessible vehicles and to reduce paratransit demand. **Bridgeport, Connecticut,** adopted free fares on fixed-route services for those with disabilities at the same time they increased paratransit fares and introduced a comprehensive travel training program. This program significantly affected ridership on paratransit service and fixed-route service—decreasing the former and increasing the latter.

Before the fare incentive, paratransit ridership had been increasing 30 to 40 percent each year; after the program was implemented, ridership grew only 9 percent annually. Fixed-route service, which had been declining steadily for the 3 years before the fare incentive program, grew 5 percent immediately after the fare program. Overall, free travel on the fixed-route system was responsible for shifting approximately 6,300 trips from paratransit to fixed route; 5 percent of those shifted had never before used fixed-route services.

Most of the travelers who shifted to fixed route had previously been eligible for a half-price fare of $0.40[53]. Before the program, reduced fare rides were fairly constant (between 37,000 and 39,000 per month); immediately after the program began, the number of reduced- and free-fare rides (that is, by seniors and those with disabilities) rose by more than 7,100 per month (in May of 1994, the system carried 49,000 free-and reduced-fare rides)[54].

Capital Metro in Austin, Texas, retained free fares for those with disabilities when it abandoned its systemwide free-fare policy; as a result, the system had more than 5,000 wheelchair boardings per month in 1993 (which is roughly equivalent to what systems 8 to 10 times bigger are experiencing[55]).

Several systems have important ridership from among 12- to 17-year-olds directly linked to pass programs. The **New Orleans Regional Transit Authority** reports that this student population is its most successful market segment, possibly because the school district buys and distributes student passes. The Tucson Unified School District also buys transit passes for its students to ride **SUNTRAN**; students account for 15 percent of all pass users. **Centro**, the Syracuse system, provides 80 percent of all bus service to junior and senior high schools; the local Board of Education issues passes to students which are only valid on school routes, during school hours. Centro is reimbursed for the number of passes distributed.

Facilitating Transfers

Many systems charge an additional fee for riders transferring from one route or transit mode to another. This reduces the attractiveness of transit to those who need to link several trips. A previous section discussed how transit systems can eliminate transfers (by various route restructuring concepts) and facilitate transfers (by timed and/or guaranteed transfers and developing suburban transit centers). For those transfers that remain, some pricing options may also encourage ridership.

The **Capital Metropolitan Transportation Authority** (Austin, Texas) has targeted working parents with its new transfer policy. The policy was designed in response to an increase in "chaining of trips" where riders leave the bus to drop off children at daycare, go grocery shopping, or do other

errands before reaching their destination. The transfer policy allows riders to reboard and continue travel on the same route. Time for reboarding was increased to 3 hr on weekdays and 4 hr on weekends. Transfers are free if requested when the fare is paid. This change was made 18 months ago; during that time there has been a 3 percent growth in ridership.

Tidewater Regional Transit also has offered a "stop and go" transfer for many years. The increase in trip chaining activity is evident in the increased sales of this transfer. As part of an upgrading of its on-board fare collection system, the **Delaware Administration for Regional Transit (DART)** in Wilmington, Delaware, introduced a transfer that is the equivalent of a 90-min systemwide bus pass. The target market for this transfer consists of residents of the urban core who make short trips. With the new transfer policy, they can complete a round trip in the allotted time.

Subsidized Vanpools

The **Harris County Metropolitan Transit Authority** (Houston Metro) coordinates the private operation of vanpools throughout Harris County by providing matching subsidies for their operations. Currently, Metro has 104 vans in service, with an average monthly ridership of 40,737. Metro contracts out van operation and maintenance to several private providers; by advertising and marketing the program and subsidizing roughly three-fourths of the costs, the system reports 39,000 passenger trips per month as transit trips. Service is largely provided from one suburb to another; less than 10 percent of the vanpools go downtown, in large measure, because the core transit service is very good. Much of the ridership is traveling to or from medical centers—25 percent of all vans are serving just one suburban medical complex. Most riders are workers but there are a few students vanpooling as well. Most riders are believed to be former car drivers or passengers.

The **Capital Metropolitan Transportation Authority** (Austin, Texas) markets and subsidizes a vanpool program; they currently support 100 vanpools (4 outside the service area) by contracting with VPSI, a private firm, for the vehicles, maintenance, and insurance. The vanpools provide almost 400,000 annual passenger trips. Riders within the system's service area pay $10 each per month while those not in the service area pay by the mile or an average of $120 per month; Capital Metro subsidizes all additional costs. Riders may also purchase "insurance" for a guaranteed-ride-home program; for $5 per year they are eligible for up to four rides home per year, provided by a taxi operator under contract to Capital Metro.

The Austin system organizes roughly 3 new vanpools each month; they expect to have more than 200 by the end of the century. They currently have 90 people on a vanpool waiting list. In general, the system will not organize a vanpool until there are at least seven to eight guaranteed riders.

Community Transit (north of Seattle) operates a vanpool system which accounts for almost 4 percent of annual ridership. CT's program leases vans to qualified commuter groups with an origin or destination in Snohomish County; currently 142 vans are in operation (3 of which are lift-equipped). More than 80 percent of the vanpools travel to major employment centers in the county, carrying just over 200,000 trips per year. Ridership has increased 74 percent between 1991–94.

PACE, the suburban bus division of Chicago's Regional Transportation Authority, has a vanpool incentive program to serve the needs of small groups of workers. The vanpool program, VIP, provides passenger vans to 5 to 15 people who pay the operating costs; in 1995 there were 172 vans running with more than 90 percent in suburb-to-suburb operation. The fares vary according to distance and the number of passengers, but they have been covering more than 100 percent of operating costs. Recently the vanpool program has been expanded to serve workers with disabilities living outside the ADA paratransit service area; in 1995, there were 20 "ADvAntage" vans in operation.

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APPENDIX G
ATTRIBUTES SOUGHT BY VARIOUS MARKET GROUPS

INTRODUCTION

This appendix describes how various transit service concepts might provide the service attributes sought by various market niches. Service concepts are matched to actual/potential market segments and to individual service environments.

SERVICE CONCEPTS MATCHED TO TRANSIT MARKETS

Prior analyses performed for this project made clear that different market niches use transit more than average (when controlling for income) in different service environments. While some market niches are important markets for operators in most or all service environments, others are only more likely to use transit in a few service environments. For example, women, Blacks, and Hispanics created transit markets in almost all of the 14 service environments; older workers (over 65) are only a transit market in a few service environments. This analysis, then, assumes that any given service concept would meet the needs of potential markets in some service environment and not in others; the following tables attempt to match concepts and the market niche they might serve to various service environments.

Table G-1 is concerned with those service concepts that make transit feasible or practical; overall, these options work best in medium- or high-density service areas of at least 500,000 people. Some options, such as joint development and transit-supportive neighborhoods, probably only create transit markets in high-density areas over one million. Some options, such as travel training or marketing, could work in any size community.

Table G-2 focuses on those service concepts that make transit convenient; most of these options work best in low- to medium-density service environments under 500,000. Some, such as smaller transit vehicles, can work in larger service environments although they seem better suited to smaller ones. Smartcards and other sophisticated fare paying mechanisms probably only make sense in very large service environments.

Table G-3 matches those transit service concepts that make transit faster or more direct with various market niches. These concepts are the most effective in creating transit markets in medium- to high-density areas over 500,000 and often over one million. Some concepts, such as route restructuring, are so broad that various elements (e.g., suburb-to-suburb service, interlining, and cross-town routes) could be used in any service environment to attract certain transit markets.

Table G-4 covers transit service concepts that make transit cheaper. These are the only set of concepts that can create transit markets in all service environments, regardless of size or density.

TABLE G-1 Service concepts: feasible/practical

	By Service Environment	
	WORK TRIPS	**NON-WORK TRIPS**
REVERSE COMMUTE		
FEEDER ROUTES		
500,000 - 1 Million 1 Million Plus	Medium Density High Density	
	• Women • People with out Cars • People with Household Incomes <$15,000 • Blacks • Hispanics • Asians • College and Graduate School Education • People 17-29 • People with High School Degree • Immigrants	• People with Household Incomes <$15,000 • Women • College and Graduate Education
SERVICE TO LARGE EMPLOYERS / UNIVERSITIES		
500,000 - 1 Million 1 Million Plus	Medium Density High Density	
	• Women • People without Cars • People with Household Incomes <$15,000 • Blacks • Hispanics • Asians • College and Graduate School Education • People 17-29 • People with High School Degree • Immigrants	• People 17-29 • College and Graduate School Education
GUARANTEED RIDE HOME		
CHILDCARE FACILITIES		
CONCIERGE SERVICES		
500,000 - 1 Million 1 Million Plus	Medium Density High Density	
	• Women • College and Graduate School Education • People with Household Incomes <$15,000	
TRAVEL TRAINING		
TRANSIT FAMILIARIZATION PROGRAMS		
All Service Environments	All Densities	
		• People 65+ • People without Cars

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TABLE G-1 ***(continued)***

	By Service Environment	
	WORK TRIPS	**NON-WORK TRIPS**
MARKETING AND ADVERTISING		
500,000 - 1 Million 1 Million Plus	Low Density Medium Density High Density	
	• People without Cars • People with Household Incomes <$15,000 • People 17-29 • People with High School Degree • Immigrants	• People 65+ • People without Cars • People with House Hold Incomes <$15,000 • People 17-29 • People with High School Degree • Immigrants
JOINT DEVELOPMENT		
TRANSIT SUPPORTIVE NEIGHBORHOODS		
1 Million Plus	Medium Density High Density	
	• Women • People without Cars • People with Household Incomes <$15,000 • Blacks • Asians • Hispanics • College and Graduate School Education • People 17-29 • People with High School Degree • Immigrants	• Women • People without Cars • People with Household Incomes <$15,000 • Blacks • Asians • Hispanics • College and Graduate School Education • People 17-29 • People with High School Degree • Immigrants

* A *Transit Market* = a market niche matched to specific service environments

TABLE G-2 Service concepts: more convenient

	By Service Environment	
	WORK TRIPS	NON-WORK TRIPS
ROUTE DEVIATION		
FLEX ROUTES		
ROUTE EXTENSION		
LATE NIGHT / REQUEST STOP		
50,000 - 200,000 ▶ Very Low Density 200,000 - 500,000 Low Density		
	• Women • People without Cars • People with Household Incomes <$15,000 • Blacks • Hispanics • Asians • College and Graduate School Education • People 17-29 • People with High School Degree • People 65+	• Women • People without Cars • People with Household Incomes <$15,000
ROUTE EXTENSION		
LATE NIGHT / REQUEST STOP		
50,000 - 200,000 ▶ Very Low Density 200,000 - 500,000 Low Density		
	• Women • People 65+	• Women • People without Cars • People with Household Incomes <$15,000 • Blacks • Hispanics • Asians • People 65+
DOWNTOWN LOOPS/CIRCULATORS		
NEIGHBORHOODS LOOPS/CIRCULATORS		
200-500,000 ▶ Medium Density 500-1 Million High Density 1 Million Plus		
	• Women • People without Cars • People with Household Incomes <$15,000 • Blacks • Hispanics • Asians • College and Graduate School Education • People 17-29 • People with High School Degree • People 65+	• Women • People without Cars • People with Household Incomes <$15,000 • Blacks • Hispanics • Asians • College and Graduate School Education • People 17-29 • People with High School Degree • People 65+

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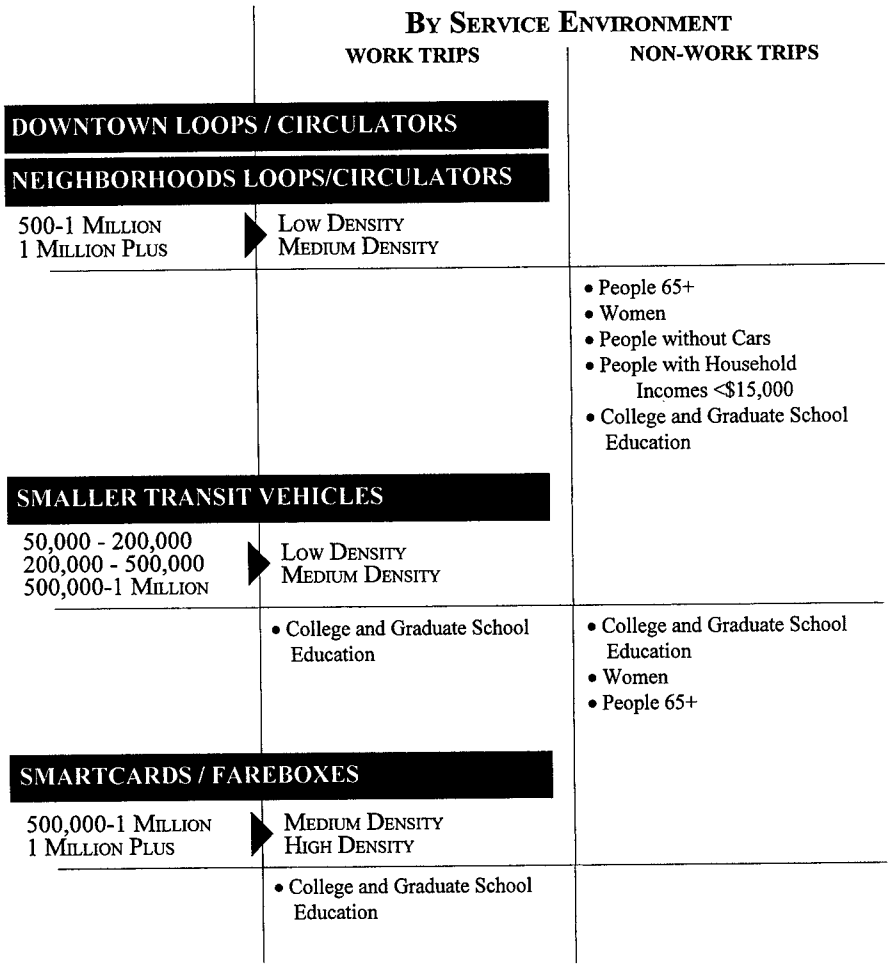
TABLE G-2 *(continued)*



* A *Transit Market* = a market niche matched to specific service environments

TABLE G-3 Service concepts: faster and more direct

	By Service Environment	
	WORK TRIPS	**NON-WORK TRIPS**
HOV LANES		
EXPRESS / LIMITED STOP SERVICE		
COMMUTER RAIL		
500,000 - 1 Million 1 Million Plus	Medium Density High Density	
	• College and Graduate School Education • Immigrants • Women	
PRIORITY BUS TRAFFIC		
500,000 - 1 Million 1 Million Plus	Medium Density High Density	
	• Women • College and Graduate School Education • Immigrants • People 65+	• People 65+ • College and Graduate School
FACILITATING TRANSFERS		
SUBURBAN TRANSIT CENTERS		
200-500,000 500,000 - 1 Million 1 Million Plus	Low Density Medium Density High Density	
	• People without Cars • People with Household Incomes < $15,000 • Blacks • Hispanics • Asians • People with High School Degrees • Immigrants	• People without Cars • People with Household Incomes < $15,000 • People 65+
ROUTE RESTRUCTURING		
200-500,000 500,000 - 1 Million 1 Million Plus	Low Density Medium Density High Density	
	• Women • People without Cars • People with Household Incomes < $15,000 • College and Graduate School Education • Immigrants • People 17-29 • People with High School Degrees	• Women • People without Cars • People with Household Incomes < $15,000 • People 65+

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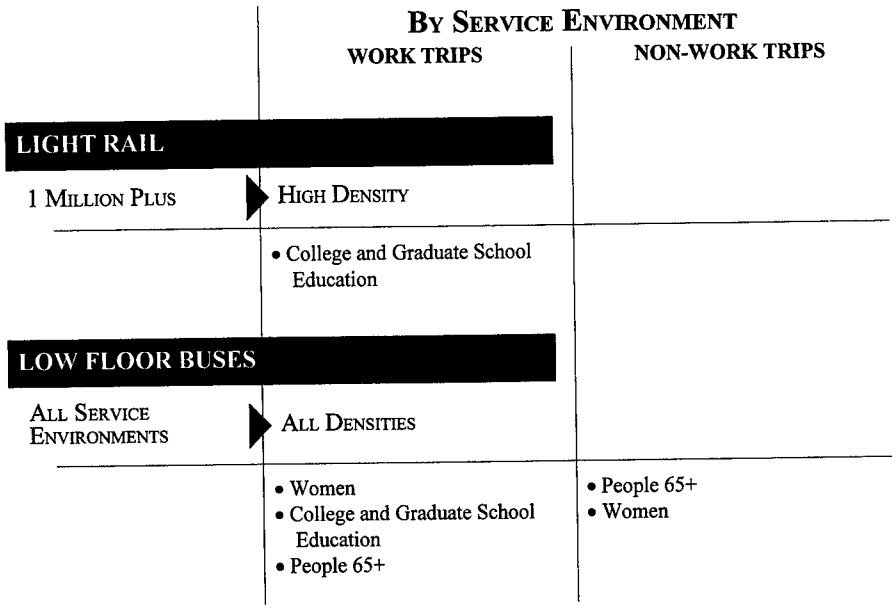
TABLE G-3 (*continued*)



* A *Transit Market* = a market niche matched to specific service environments

TABLE G-4 Service concepts: cheaper

	By Service Environment	
	WORK TRIPS	**NON-WORK TRIPS**
FARE INCENTIVES		
TRANSFER POLICIES		
All Service Enviroments ▶ All Densities	• People without Cars • People with Household Incomes < $15,000 • Blacks • Hispanics • Asians • Immigrants	• People without Cars • People with Household Incomes < $15,000 • Blacks • Hispanics • Asians • Immigrants • People 17-29 • People 65+
VANPOOL / CARPOOL SUBSIDY		
All Service Enviroments ▶ All Densities	• People with Household Incomes < $15,000 • People without Cars • Blacks • Hispanics • Asians • College and Graduate School Education • People 17-29 • People with High School Degrees • Immigrants	• People with Household Incomes < $15,000 • People without Cars • Blacks • Hispanics • Asians • College and Graduate School Education • People 17-29 • People with High School Degrees • Immigrants

* A *Transit Market* = a market niche matched to specific service environments

APPENDIX H
GLOSSARY

Concierge Service: services provided at transit facilities for the convenience of the traveller. Services include car maintenance, dry cleaning, diaper service, food/drinks, transit travel assistance, etc.

Dedicated Busways/Tunnels: capital improvements designed to speed transit through congested areas. Facilities can either bypass or integrate with other transportation.

Demand-Responsive Service: a shared-ride community-oriented service where a vehicle can pick up passengers and deliver them to a local destination as requested; it has no fixed-route or schedule. Dial-a-ride is a synonym. Although often provided to elderly and disabled passengers, it can and has been offered to the general public (see general public dial-a-ride below).

Downtown Loops/Circulators: routes that travel within a CBD, often during peak commute and lunch hours. Smaller vehicles are often used, to differentiate from regular transit buses.

Express Service: connects residential areas with activity centers using high-speed facilities, e.g., a freeway, turnpike, or busway with limited stops at each end for collection and distribution. (See limited service below.)

Facilitating Transfers: networks of suburban transit centers, flexible transfer policies, coordinated transfer points, and capital improvements designed to simplify transferring between vehicles and services.

Fare Incentives: policies and passes offered by the transit system in order to gain and maintain regular ridership. Includes recreation, school, university, and employee passes, as well as free rides for riders who are elderly or have disabilities. Free/reduced fare trips can encourage those who are elderly or have disabilities to use fixed-route transit instead of paratransit. Some systems dedicate downtown areas as "free ride zones."

Feeder Service: service that picks up and delivers passengers to a rail station, transit center, park-and-ride terminal, or other transfer facility. Can be used to connect suburban employment concentrations to rail and regional bus facilities.

Flex-Routes: one transit vehicle provides several types of service, switching between paratransit, deviating fixed-route, express route, and local fixed-route services, depending on density of service area, peak hours, and demand. Can serve cross sections of market by different service, while maintaining same driver and vehicle.

General Public Dial-A-Ride: demand-responsive service available to the general public as well as those who are elderly or have disabilities. (See demand-responsive service and "smart" demand-responsive transportation.)

Guaranteed Ride Home: service that provides emergency transportation for people who usually use transit or carpools/vanpools but must return home and do not have other transportation available. Service can be provided by taxis or company vans.

HOV Lanes: separate lanes provided for high-occupancy (two or more passengers) vehicles, including transit as well as personal vehicles. HOV lanes vary from curbside lanes and movable directional barriers to separate median lanes for sole HOV use. Busways are a form of HOV lanes, provided solely for the use of transit vehicles; no private vehicles are allowed. Designed to encourage carpooling through potential bypassing of single-occupant vehicle (SOV) traffic.

Joint Development: transit, commercial, and mixed-use facilities built together to increase transit use and building revenues.

Limited Service: higher speed arterial service serving only selected stops during certain periods of the day. Unlike express service, there is no significant portion using an exclusive right-of way. *Skip-stop service* is a synonym. (See express service.)

Low-Floor Buses: Forty-foot transit coaches having no steps and no impediments between the front and rear doors. Floor level is typically no more than 15 inches from the ground. Ramps may be used for access from curbs to floor level.

Neighborhood Circulators: often smaller transit vehicles that circulate on secondary routes through residential areas and serve shopping, recreation, and possibly work destinations. The routes may connect to major fixed-route service as well or operate as isolated localized service. The main intention is to bring transit as close as possible to potential riders.

Park-and-Ride Facilities: suburban facilities for commuters travelling from suburbs. Service is often provided during peak hours on express routes into downtown areas.

Priority Bus Traffic: timing of signals as well as bypasses and ramps designed to get buses through traffic faster than automobiles.

Request-a-Stop: often a late-night service, allowing passengers to board/disembark anywhere along a route, not just scheduled stops. Designed for passenger safety, to reduce walking distances late at night.

Reverse Commute: transportation provided to accommodate central city workers travelling to suburban employment concentrations. Can be a change in schedule or route to accommodate suburban work sites or a feeder service from regional bus and rail service.

Route Deviation: vehicles deviate from a route to pick up or drop off passengers. Routes may be fixed or based on checkpoints and windows of service time. Buses may provide service for all passengers or solely for passengers who are elderly or have disabilities and are registered with agency.

Route Extension: optional continuation of a route into low-density and low-demand areas. Riders can either request service upon boarding or from a remote stop by advance reservation. Optional extensions optimize efficiency by reducing or eliminating unproductive trips. Combined with route turn back, it operates as a flexible routing option for low-density areas. (See route turn back.)

Route Restructuring: major changes in the route network, schedules, stops, and modes of service in response to changing travel requirements. Variations or components are as follows:

- **Crosstown Route:** a nonradial bus route that does not enter the CBD. Provides service to commercial and industrial centers in the suburbs; normally provides connections with regional bus and rail services.
- **Interlining:** use of the same vehicle on more than one route without requiring passengers to transfer. Joins the ends of radial routes to travel through the downtown instead of having vehicles turn back or lay over in the downtown. *Through* or *interlocking routes* are used as synonyms. Designed to serve different markets during peak and off-peak periods.
- **Route Extension:** the continuation of a fixed route into previously unserved (often suburban) areas, in place of introducing a separate route. Makes more efficient use of existing services to reach new markets.
- **Route Streamlining:** changes designed to eliminate unproductive branches and route duplication. When change reduces travel time and improves alignment of service on arterial streets, it improves service for commuters, especially for those residing in medium-density areas where routes may reflect previous demand.

Route Turnback: changes designed to shorten the length of a route during off-peak periods. *Short turn* is a synonym. It allows more service to be provided in high- and medium-density areas without the additional cost of maintaining service in lower density areas. (See route extension.)

Small Bus: a bus 28 feet or less in length.

Smart Cards/Fare Boxes: application of technology to farebox payments that "senses" fare cards from a distance without having to physically read them. Designed to speed up and facilitate the boarding/fare payment process. Software can also collect more accurate ridership and fare data.

Smart Demand-Responsive Transportation: Dial-a-ride shuttles that operate with the assistance of technology; software for vehicle location, dispatch, and scheduling allows for immediate demand-responsive service.

Suburban Transit Centers: Multiple facilities for transfers provided in suburban areas, eliminating the need to travel into downtown areas to transfer between routes. Used in conjunction with suburb-to-suburb links (see below).

Suburb-to-Suburb Links: provides service between outlying areas without traveling through the CBD. Service between areas can be provided by express routes or local service.

Taxi Substitution: taxis used to replace bus service when not feasible in an area. Useful in low-density, low-demand areas where fixed-route service is not efficient.

Timed Transfer: a location where two or more routes come together at the same time to facilitate the transfer of passengers. A short layover may be provided at the timed transfer location to enhance connections. Timed transfers have allowed the restructuring of suburban services into hub-and-spoke networks. *Pulse transfer* is a synonym. Provides a wider range of destinations for suburban travelers.

Transfer Policies: extended transfer times and multi-mode transfers used as incentives for passengers. Allows for trip linking instead of making multiple trips.

Transit Familiarization: programs designed to familiarize potential riders with experiences that will be encoun-

tered in riding transit vehicles, such as boarding and alighting, fare payment, requesting stops, and route travel. Designed to encourage riders unfamiliar with transit to travel, once accustomed to what will be encountered while traveling.

Transit-Supportive Neighborhoods: cooperative development of transit and supporting commercial/public facilities in neighborhood areas. Designed to develop a "transit area" for the community's use.

Travel Training: a training program designed to teach people, generally those with mental or visual disabilities, how to ride a bus or train. Can be quite lengthy and complex, depending on the disability of the riders.

Vanpool/Buspool: where a group of individuals organize to share all or part of the cost of operating the vehicle. When there are more than 15 passengers, it is normally called a buspool. Generally marketed to commuters employed at a single destination.